NuclideNavigator® III

Interactive Gamma Ray Reference and Library Program for Microsoft® Windows® 95/98/NT

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Software User's Manual

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TABLE OF CONTENTS

1. INTRODUCTION 1
   1.1. Viewing Nuclide Information 1
   1.2. Database Queries 1
   1.3. Library Management 2
   1.4. Other Views 2
   1.5. Hardware 2

2. NUCLIDE INFORMATION 3
   2.1. Segrè Chart View 3
   2.2. Nuclide Information Screen 9
      2.2.1. File 10
      2.2.2. Options 11
      2.2.3. Specific Activity... 11

3. SEARCHING 13
   3.1. Unknown Gamma Ray Identification 13
      3.1.1. Energy and Range 14
      3.1.2. Half-Life Range 14
      3.1.3. Match Associated Lines 15
      3.1.4. Method of Nuclide Generation 15
   3.2. Search Results 15

4. LIBRARY MANAGEMENT 19
   4.1. Library Manager View 19
   4.2. Library Creation 21
   4.3. Library Modification 22
      4.3.1. Adding a Nuclide 23
      4.3.2. Deleting a Nuclide 24
      4.3.3. Editing Nuclide Properties 24
      4.3.4. Adding Emissions 24
      4.3.5. Deleting a Gamma Ray 25
      4.3.6. Modifying Gamma Ray Information 25
      4.3.7. Reordering Gamma Rays 25
   4.4. Library Reporting 25
   4.5. Example 30

5. APPLICATION LIBRARIES 37
   5.1. NATURAL.LIB 37
   5.2. NPP.LIB 37
   5.3. FOOD.LIB 37
   5.4. NAC.LIB 38

5.5. DET.LIB . . . 38
5.6. SUSPECT.LIB . . . 38
5.7. CALIBRATION LIBRARIES . . . 38
5.7.1. MIXCLB.LIB . . . 38
5.7.2. SRM4275.LIB . . . 39
5.8. PROMPT GAMMA LIBRARY . . . 39

6. MENU COMMANDS . . . 41
6.1. Segrè Chart Screen . . . 41
6.1.1. File . . . 41
6.1.1.1. Open Source Library... . . . 41
6.1.1.2. Recent Sources ▸ . . . 41
6.1.1.3. Save Source As... ▸ . . . 42
6.1.1.4. Page Setup . . . 42
6.1.1.5. Print ▸ . . . 42
Chart Section . . . 42
Library Data . . . 42
6.1.1.6. Library Information (Source) . . . 42
6.1.1.7. Select Target Library... . . . 42
6.1.1.8. Recent Targets ▸ . . . 43
6.1.1.9. Save Target As... ▸ . . . 43
6.1.1.10. Close . . . 43
6.1.1.11. Print . . . 43
6.1.1.12. Library Information (Target) . . . 43
6.1.1.13. Exit NuclideNavigator . . . 43
6.1.2. Options . . . 43
6.1.2.1. View/Print... . . . 43
Radiation . . . 43
Print Method . . . 44
6.1.2.2. Copy/Report... ▸ . . . 44
Number . . . 44
Special . . . 45
6.1.2.3. Library Manager... . . . 45
6.1.2.4. Segrè Chart... ▸ . . . 46
Pop-Up Menu . . . 47
6.1.3. Tools . . . 47
6.1.3.1. Zoom ▸ . . . 47
6.1.3.2. Search Library for ▸ . . . 47
6.1.3.3. Library Manager . . . 49
6.1.3.4. Periodic Chart . . . 49
6.1.3.5. Units Converter . . . 50

6.1.3.6. Decay Schemes . . . 55
6.1.4. View . . . 56
6.1.5. Help . . . 57
6.1.5.1. Contents . . . 57
6.1.5.2. Search for Help On . . . 57
6.1.5.3. Legend . . . 57
6.1.5.4. About . . . 57
6.2. Library Manager View . . . 58
6.2.1. File (Source Window) . . . 58
6.2.1.1. Open Source Library... . . . 58
6.2.1.2. Recent Sources ▸ . . . 58
6.2.1.3. Save Source As ▸ . . . 58
6.2.1.4. Page Setup . . . 58
6.2.1.5. Print . . . 58
6.2.1.6. Library Information... . . . 58
6.2.1.7. Nuclide Information... . . . 58
6.2.1.8. Exit NuclideNavigator . . . 58
6.2.2. Edit (Source Window) . . . 59
6.2.2.1. Add Nuclide... . . . 59
6.2.2.2. Edit Nuclide... . . . 59
6.2.2.3. Delete Nuclide . . . 59
6.2.2.4. Add Gamma Ray... . . . 59
6.2.2.5. Edit Gamma Ray... . . . 59
6.2.2.6. Delete Gamma Rays . . . 59
6.2.2.7. ReSort Gammas by ▸ . . . 59
6.2.3. Options (Source Window) . . . 59
6.2.3.1. View/Print... . . . 59
6.2.3.2. Copy/Report... ▸ . . . 60
Number . . . 60
Special . . . 61
6.2.3.3. Library Manager... . . . 62
6.2.3.4. Segrè Chart... ▸ . . . 62
Pop-Up Menu . . . 63
6.2.4. Tools (Source Window) . . . 64
6.2.4.1. Search Library for ▸ . . . 64
6.2.4.2. Library Manager . . . 65
6.2.4.3. Periodic Chart . . . 65
6.2.4.4. Units Converter . . . 67
6.2.4.5. Decay Schemes . . . 67
6.2.5. Help . . . 68
6.2.5.1. Contents . . . 68

6.2.5.2. Search for Help On . . . 68
6.2.5.3. About . . . 68
6.2.6. File (Target Window) . . . 68
6.2.6.1. Open Target Library... . . . 68
6.2.6.2. Recent Targets ▸ . . . 69
6.2.6.3. Save Target As ▸ . . . 69
6.2.6.4. Page Setup . . . 69
6.2.6.5. Print . . . 69
6.2.6.6. Library Information... . . . 69
6.2.6.7. Nuclide Information... . . . 69
6.2.6.8. Close Target Window . . . 69
6.2.7. Edit (Target Window) . . . 69
6.2.7.1. Add Nuclide... . . . 69
6.2.7.2. Edit Nuclide... . . . 70
6.2.7.3. Delete Nuclide . . . 71
6.2.7.4. Add Gamma Ray... . . . 71
6.2.7.5. Edit Gamma Ray... . . . 71
6.2.7.6. Delete Gamma Rays . . . 71
6.2.7.7. ReSort Gammas by ▸ . . . 71
6.2.8. Options (Target Window) . . . 72
6.2.8.1. View/Print... . . . 72
Radiation . . . 72
Print Method . . . 72
6.2.8.2. Copy/Report... . . . 72
Number . . . 73
Special . . . 73
6.2.8.3. Segrè Chart... . . . 74
Pop-Up Menu . . . 74
6.2.8.4. Library Manager... . . . 74
View Nuclide . . . 75
Edit Nuclide . . . 75
Copy Nuclide to Target Library . . . 75

APPENDIX A. INSTALLATION . . . 77
A.1. Software Installation . . . 77
A.2. Program Components . . . 77
A.3. Other Required Files . . . 77

APPENDIX B. FILE FORMAT . . . 79

INDEX . . . 81

NOTE!

We assume that you are thoroughly familiar with Microsoft® Windows 95/98/NT usage and terminology. If you are not fully acquainted with the Windows environment, including the use of the mouse, ***we strongly urge you to read the Microsoft documentation supplied with your Windows software and familiarize yourself with a few simple applications before proceeding.***

The convention used in this manual to represent actual keys pressed is to enclose the key label within angle brackets; for example, **<F1>**. For key combinations, the key labels are joined by a + within the angle brackets; for example, **<Alt + 2>**.

INSTANT INSTALLATION

Put the **NuclideNavigator III** disk in the CD-ROM drive and click on **Start**, then **Run...**. Enter **D:SETUP.EXE** in the **Run** dialog (use the drive designator for your CD-ROM drive) and click on **OK**. The remainder of the installation is automatic — just answer the installation wizard questions.

Now exit Windows, and restart the PC and Windows. Then click on **Start**, **Programs**, and **Nuclide Navigator**.

1. INTRODUCTION

NuclideNavigator is an interactive Windows program to view, query, and extract gamma-ray, alpha-ray, and beta-ray energies and yields, half-lives, parent/daughter relations, and neutron absorptions from databases. One database contains data for 2,361 nuclides, 360 alphas, 1,702 betas and 47,902 gamma rays; the other has 3,472 nuclides, 1,500 alphas, 12,753 betas, and 75,880 gammas. In addition, it can be used to build application libraries or working libraries in the GammaVision® format or the Microsoft Access® format. The GammaVision format is used by GammaVision, MAESTRO®, AlphaVision®, Renaissance®, and ScintiVision™ software. The Access format libraries are easily used in Visual Basic® or user-written programs.

Included in the database, **MASTER.MDB**, are the complete contents of "The Gamma-Rays of the Radionuclides"[1] along with alpha and beta data from the ENSDF group. Several application libraries in both GammaVision and Access formats are included. The **PC_NUDAT.MDB** database contains the complete database from the NNDC at Brookhaven National Laboratory.[2]

1.1. Viewing Nuclide Information

NuclideNavigator uses the graphical-user interface of Windows to provide an easy-to-use method of selecting and displaying nuclear data. The default mode of displaying the nuclides is the Segrè Chart (Chart of the Nuclides). To view the data from any specific isotope, just double-click on the box in the chart to display the selected information.

1.2. Database Queries

The nuclide and gamma-ray data is stored in a relational database, so it is possible to perform queries on the database for gamma-ray or alpha energies that meet the criteria selected. Using NuclideNavigator to search for specific isotopic information saves time and the printed copy is no longer needed. The search for an "unidentified" gamma ray or alpha ray by specifying simple limits about the measured sample is very easy.

The data stored with each nuclide includes the parent/daughter nuclides, the half-life, generators, references, neutron absorption cross section, nuclide type, and percent abundance for naturally-occurring elements. The data stored with each gamma ray are the energy, branching ratio or yield, and the type (X, gamma, escape); for alpha rays the energy and branching ratio are stored.

---

[1]G. Erdtmann and W. Soyka, "The Gamma-Rays of the Radionuclides," Verlag Chemie, ISBN 3-527-25816-7, Weinheim, FRG, ISBN 0-89573-022-7, New York, 1979.

[2]National Nuclear Data Center, Brookhaven National Laboratory, Upton, New York.

The Segrè Chart view can show all of the chart or only the natural series. The four natural series are displayed individually with all the decay processes shown.

1.3. Library Management

NuclideNavigator can create GammaVision libraries from the Master database to quickly develop application-specific libraries for use in analyzing gamma spectroscopy data. Once created, these application-specific libraries can be maintained and updated as required by editing the values of existing nuclides and gamma rays, or adding and deleting entire nuclides (and all associated gamma rays) or adding or deleting individual gamma rays.

1.4. Other Views

Two helpful displays can also be shown. One is the periodic chart complete with physical constants for each element. The second is a units conversion dialog. This will convert between different types of units for the same quantity. It can also be customized for special conversions.

1.5. Hardware

NuclideNavigator III will run on any PC that runs Windows 95, 98, or NT. The complete libraries use 10 MB of hard drive space.

2. NUCLIDE INFORMATION

The sections in this chapter will illustrate how to access NuclideNavigator's database using the Segrè Chart View and Nuclide Information screens. There are two modes of displaying the nuclides:

- The Segrè Chart View (explained below)
- The Library Manager View (explained in Section 4.1)

NuclideNavigator restarts using the same libraries (source and target) that were active when it was stopped and in the same viewing mode.

2.1. Segrè Chart View

The display mode showing the most detail is the Segrè Chart (Chart of the Nuclides). The Segrè Chart View can show one of two views (condensed or expanded) of the nuclide database. Fig. 1 illustrates an intermediate condensed view, while Fig. 2 shows the expanded view. The **Options** menu is used to select which view to display.

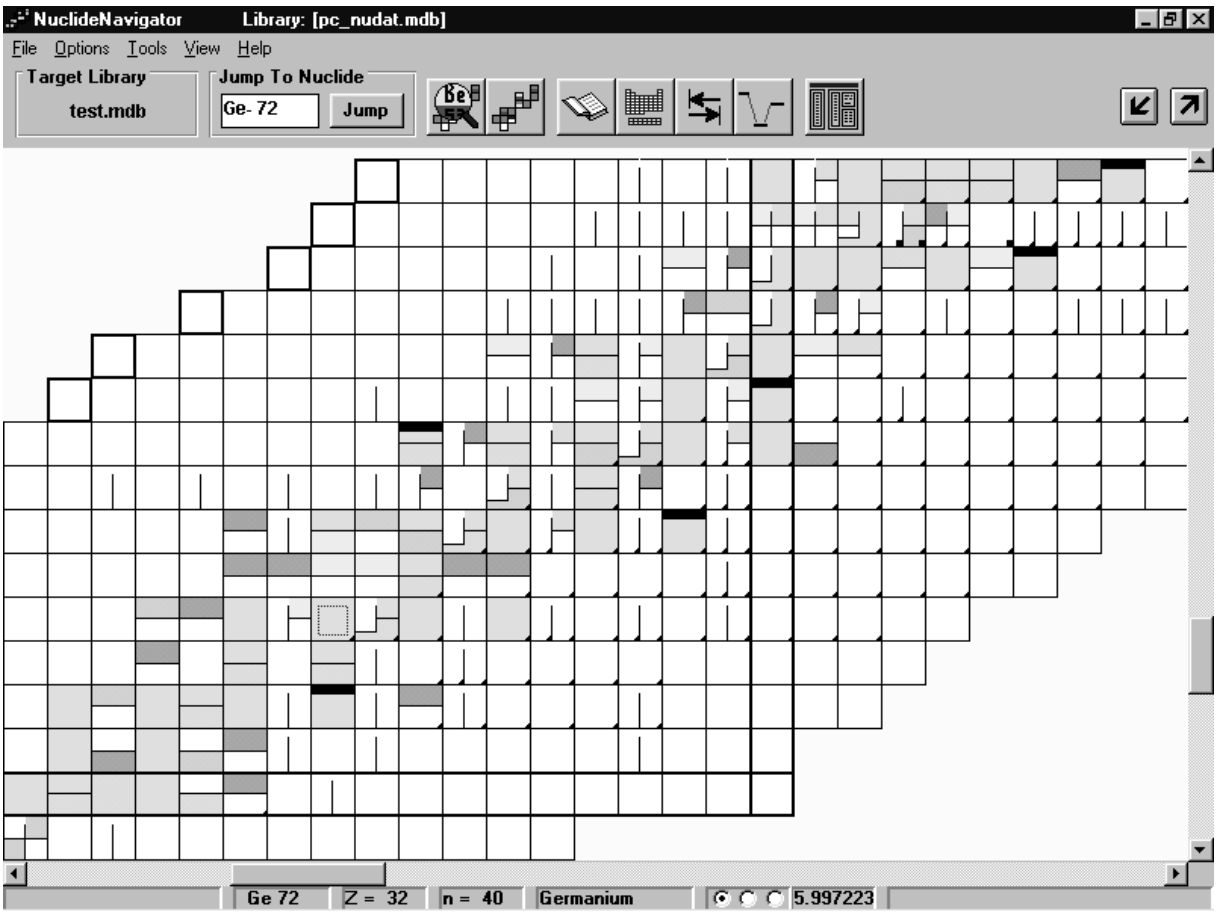

Fig. 1. Segrè Chart Condensed View.

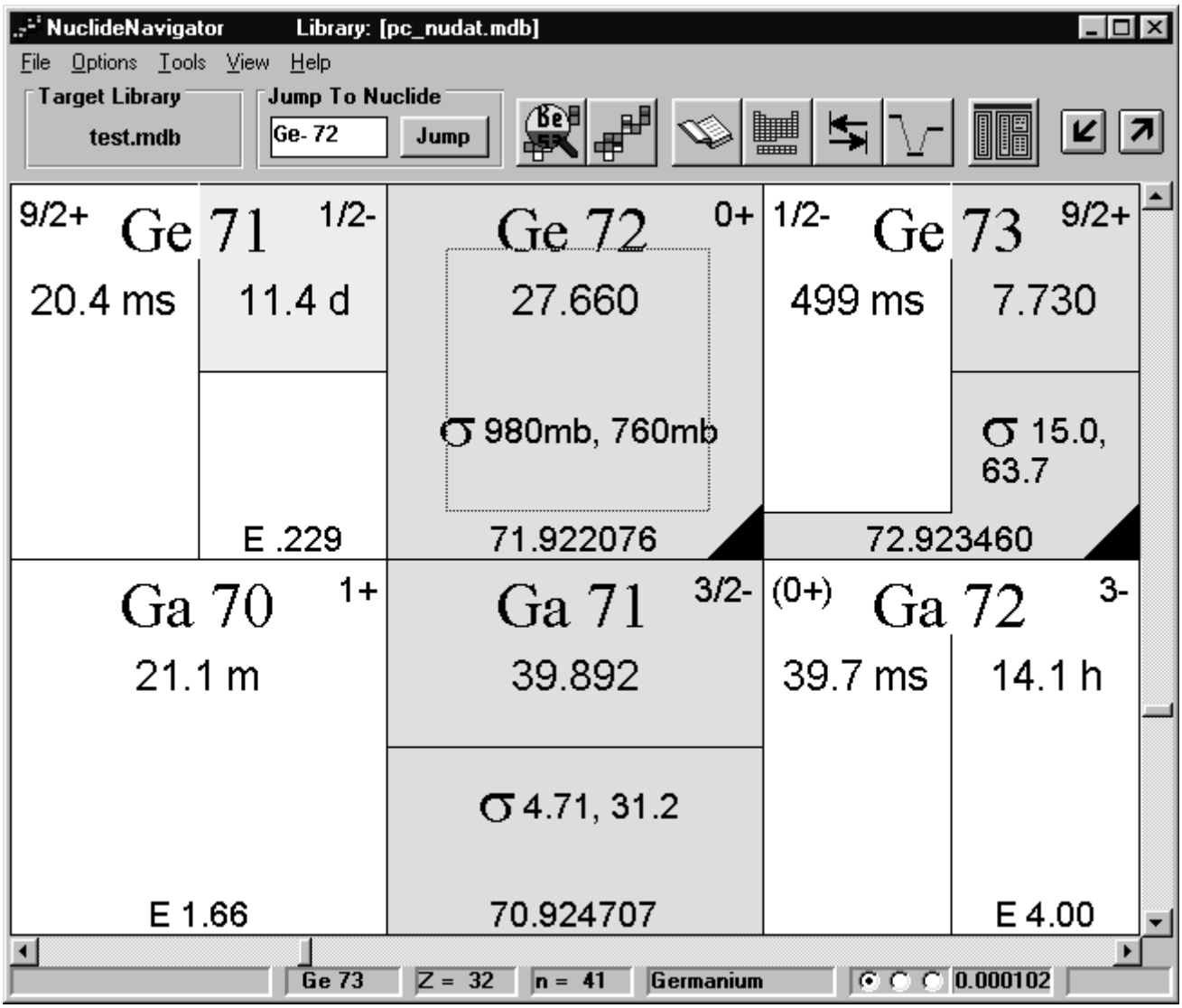

Fig. 2. Segrè Chart Expanded View.

The condensed view of the Segrè Chart gives a quick isotopic overview of the NuclideNavigator database. This view shows little detail about each isotope, but allows for quick scanning of the entire chart. This view shows naturally occurring and unstable isotopes in the same scheme as the KAPL Chart.

Note that the bottom of the screen shows the chemical symbol, atomic number, atomic mass and chemical name for the isotope under the mouse. This is true for even the most condensed view.

The expanded view of the Segrè Chart displays neutron cross sections and the elemental abundance for each stable isotope. For radioactive isotopes, the half-lives of the isotope and metastable states (if any) are displayed. Some of the information provided in the expanded view is color-coded. The **Help/Legend** describes the color and labeling scheme used. This is shown in Figs. 3 through 11.

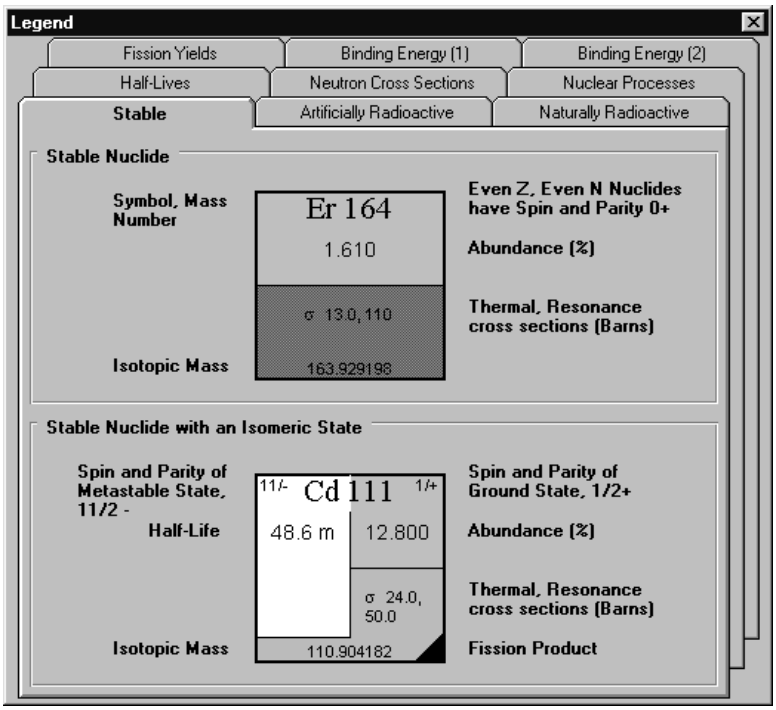

Fig. 3. Legend Menu: Stable.

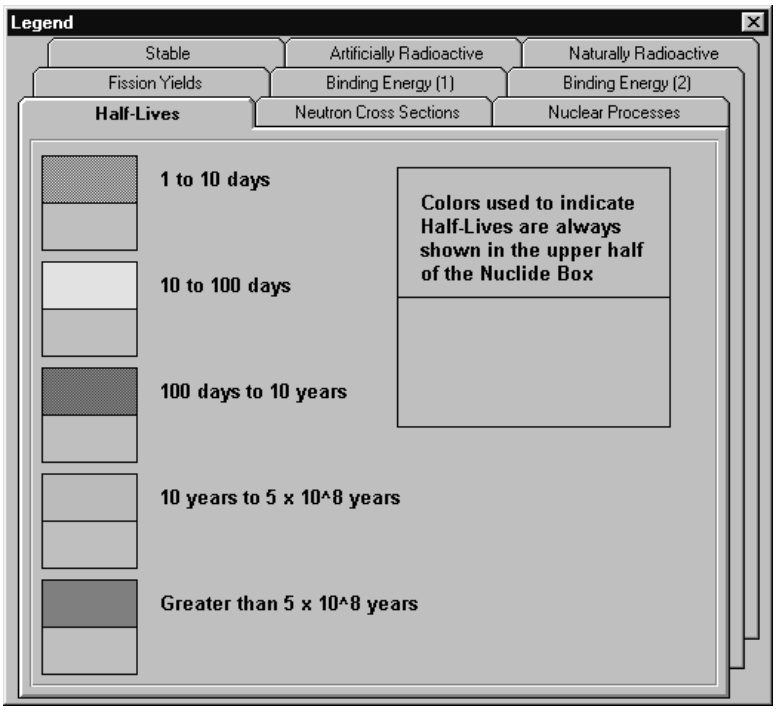

Fig. 4. Legend Menu: Half-Lives.

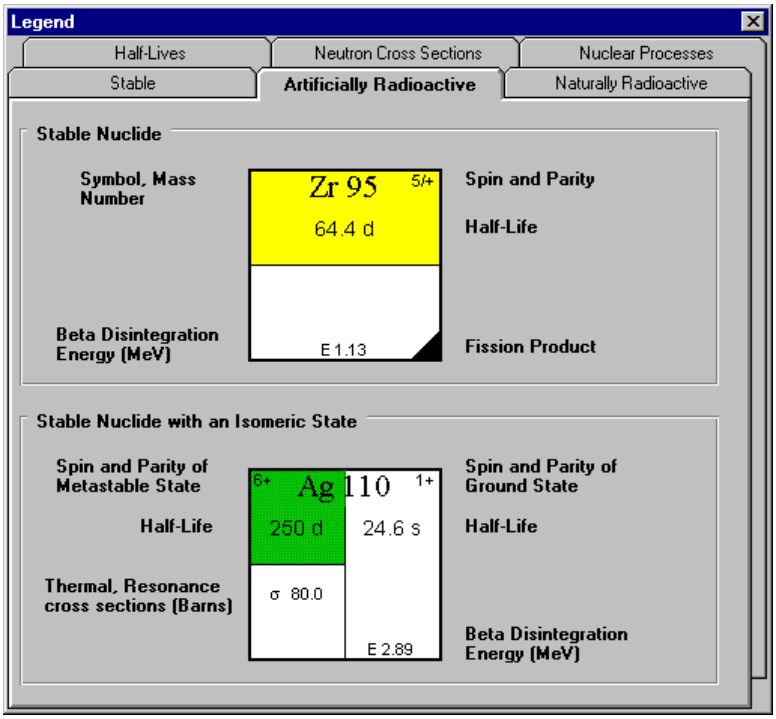

Fig. 5. Legend Menu: Artificially Radioactive.

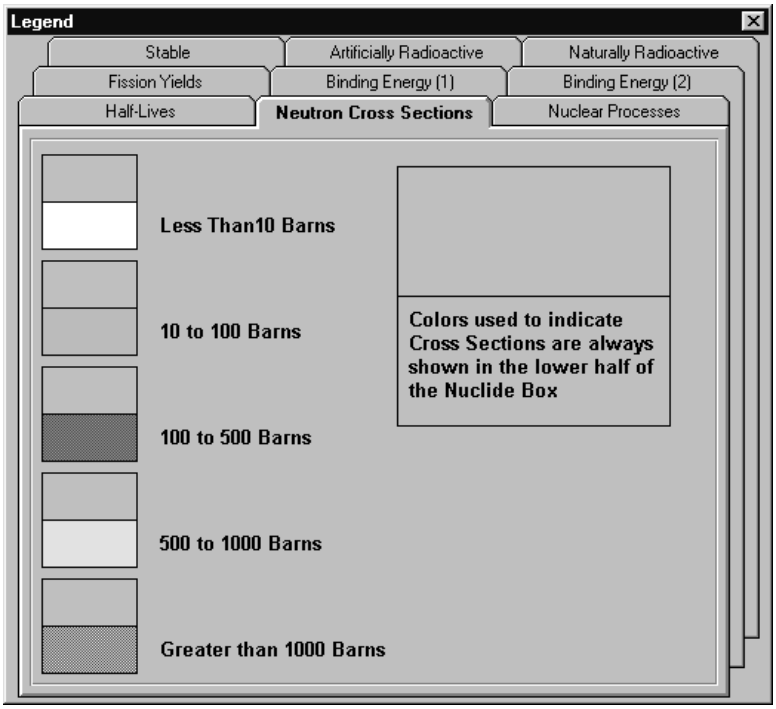

Fig. 6. Legend Menu: Neutron Cross Sections.

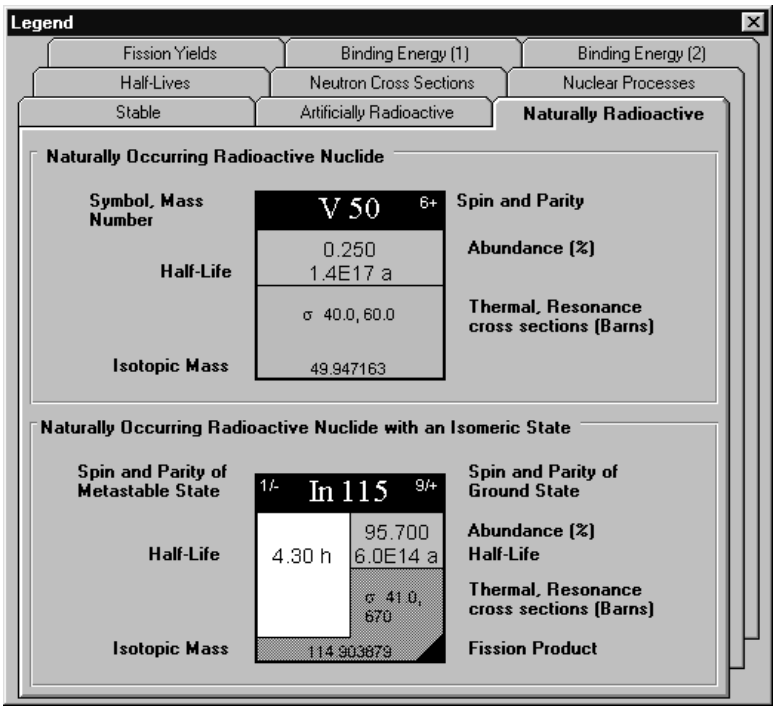

Fig. 7. Legend Menu: Naturally Radioactive.

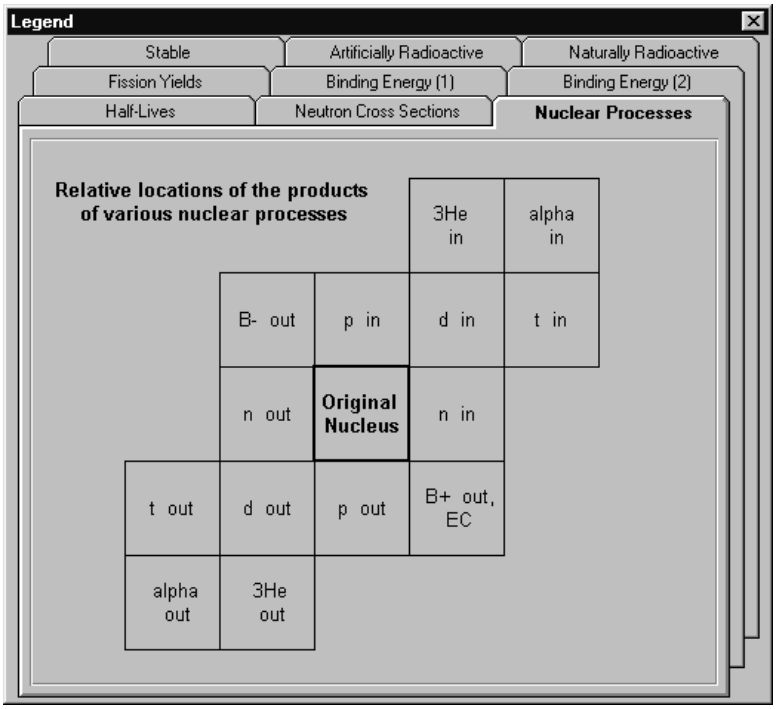

Fig. 8. Nuclear Processes.

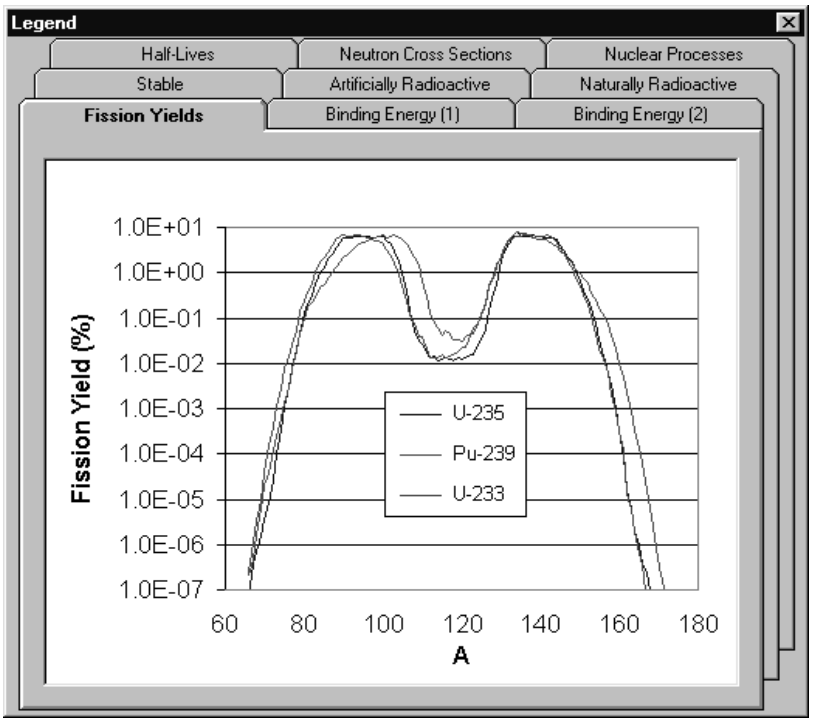

Fig. 9. Legend Menu: Fission Yields.

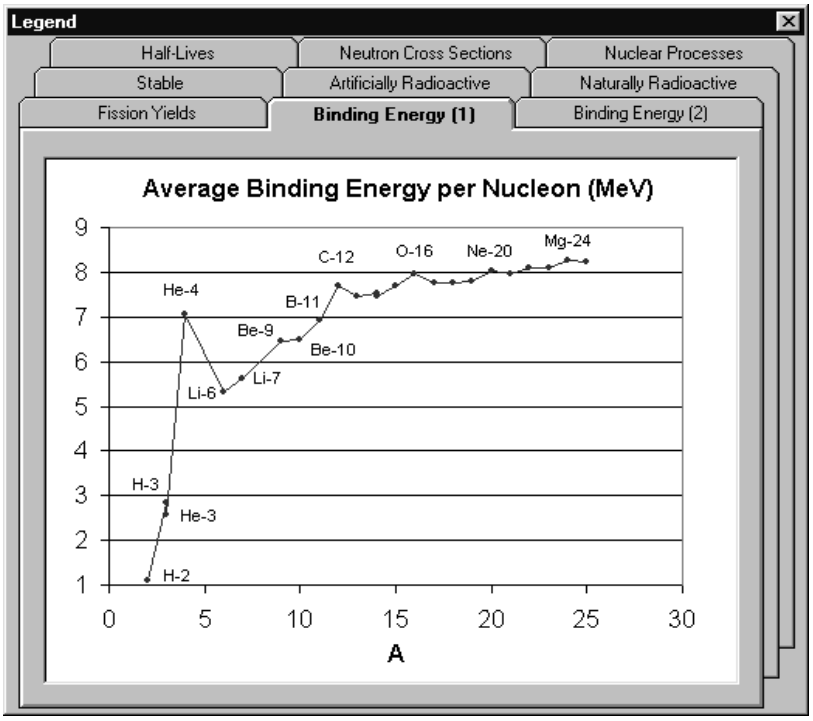

Fig. 10. Legend Menu: Average Binding Energy — 1.

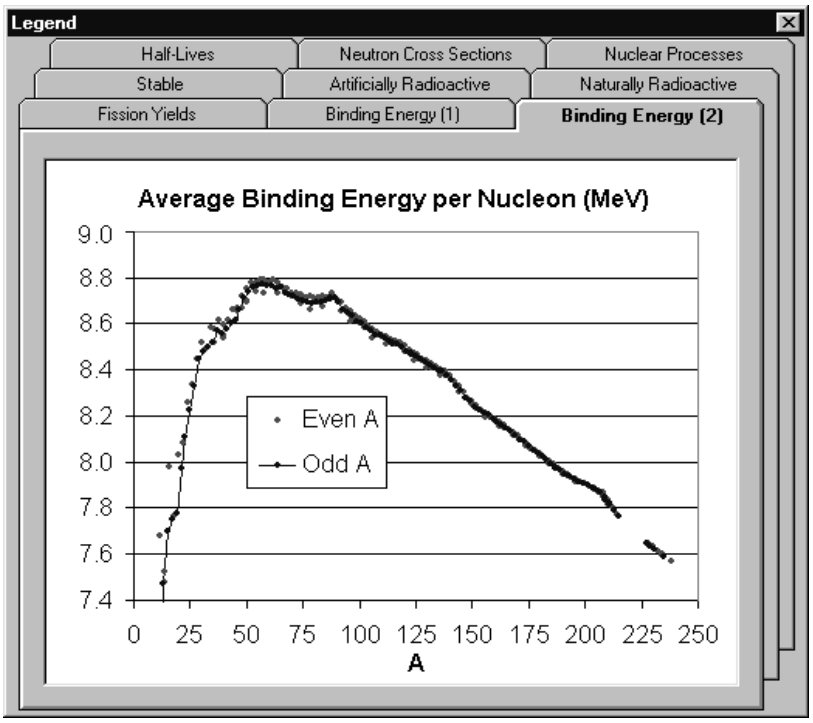

Fig. 11. Legend Menu: Average Binding Energy — 2.

There are three ways of navigating in the Segrè Chart View:

- The horizontal and vertical scroll bars
- The diagonal arrow buttons in the upper-right corner
- The **Jump To Nuclide** option

The best way to scroll through the chart is using the diagonal arrow buttons because diagonal scrolling will always keep some of NuclideNavigator's isotopes in the display area because it moves along the "line of stability." The **Jump To Nuclide** option is used to quickly go to a particular nuclide on the chart. To use this option, click in the white box to the left of the **Jump** button. Then type in the isotopic name of the isotope, e.g., **Co60**. Then click on the **Jump** button and NuclideNavigator will find that isotope and redraw the Segrè Chart View with the chosen nuclide in the lower left corner.

2.2. Nuclide Information Screen

The databases provided with NuclideNavigator contain more information about the nuclides than is presented in either of the two Segrè Chart Views. This information can be accessed by double-clicking the left button or single-click the right button on a nuclide in the Segrè Chart View and then selecting **View Nuclide** from the **Pop-Up** menu (Fig. 12). The information

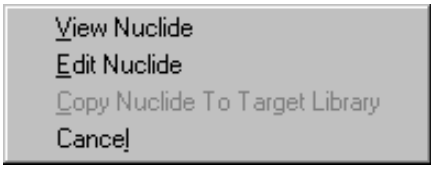

Fig. 12. Pop-Up Menu.

presented in the Nuclide Information display includes half-life, parent and daughter isotopes (if any), and the nuclide's gamma-ray, beta-ray, or alpha-ray information. The gamma-ray data displayed includes the energy, branching ratio, and associated gamma rays for each gamma ray listed. At the bottom of the screen the total number of gamma rays for the isotope is listed, along with the number actually displayed. An example of the Nuclide Information screen that appears for ^{210}Pb is shown in Fig. 13.

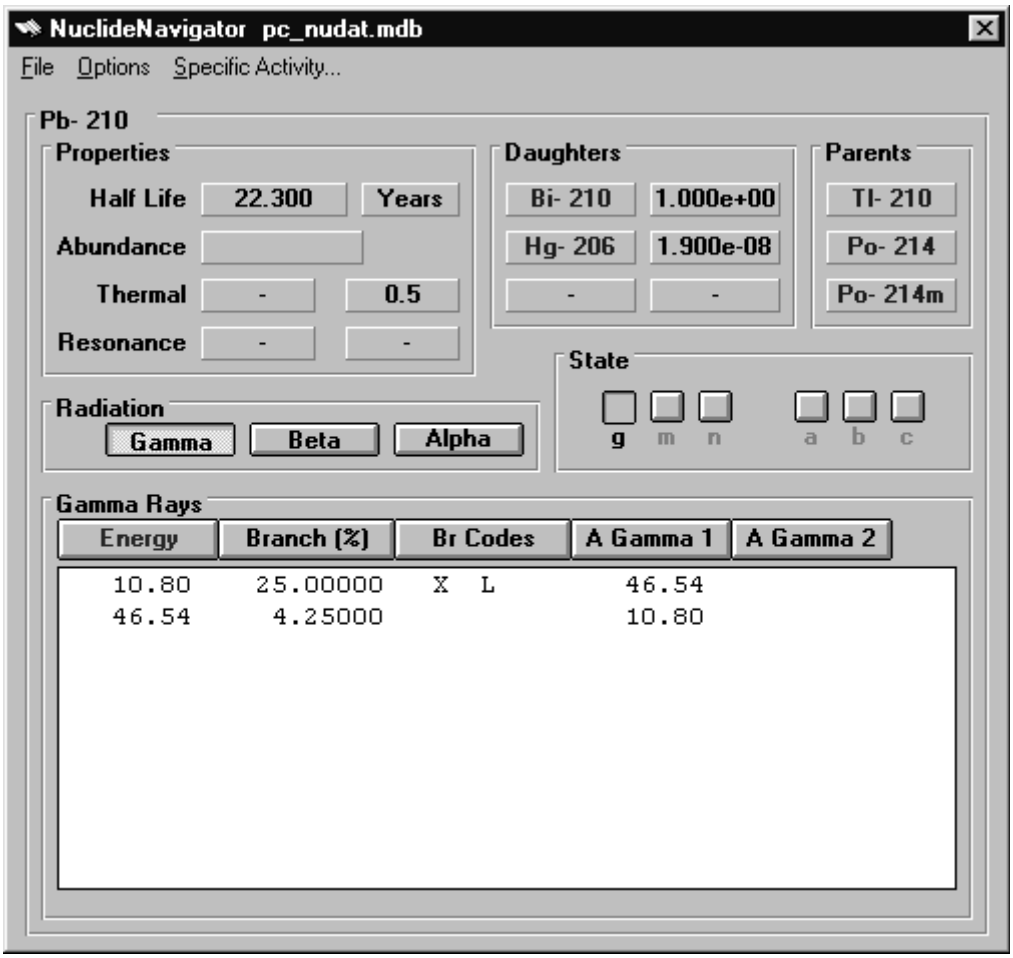

Fig. 13. Nuclide Information Screen.

The **Pop-Up** menu and number of gammas displayed is selected in the **Options** menu. These are fully explained in Chapter 6.

The Nuclide Information Screen also has a menu bar for additional functions.

2.2.1. File

The **Listing** menu shows the nuclide information in a different format as shown in Fig. 14.

The dialog can also be closed using the **Exit Form** command.

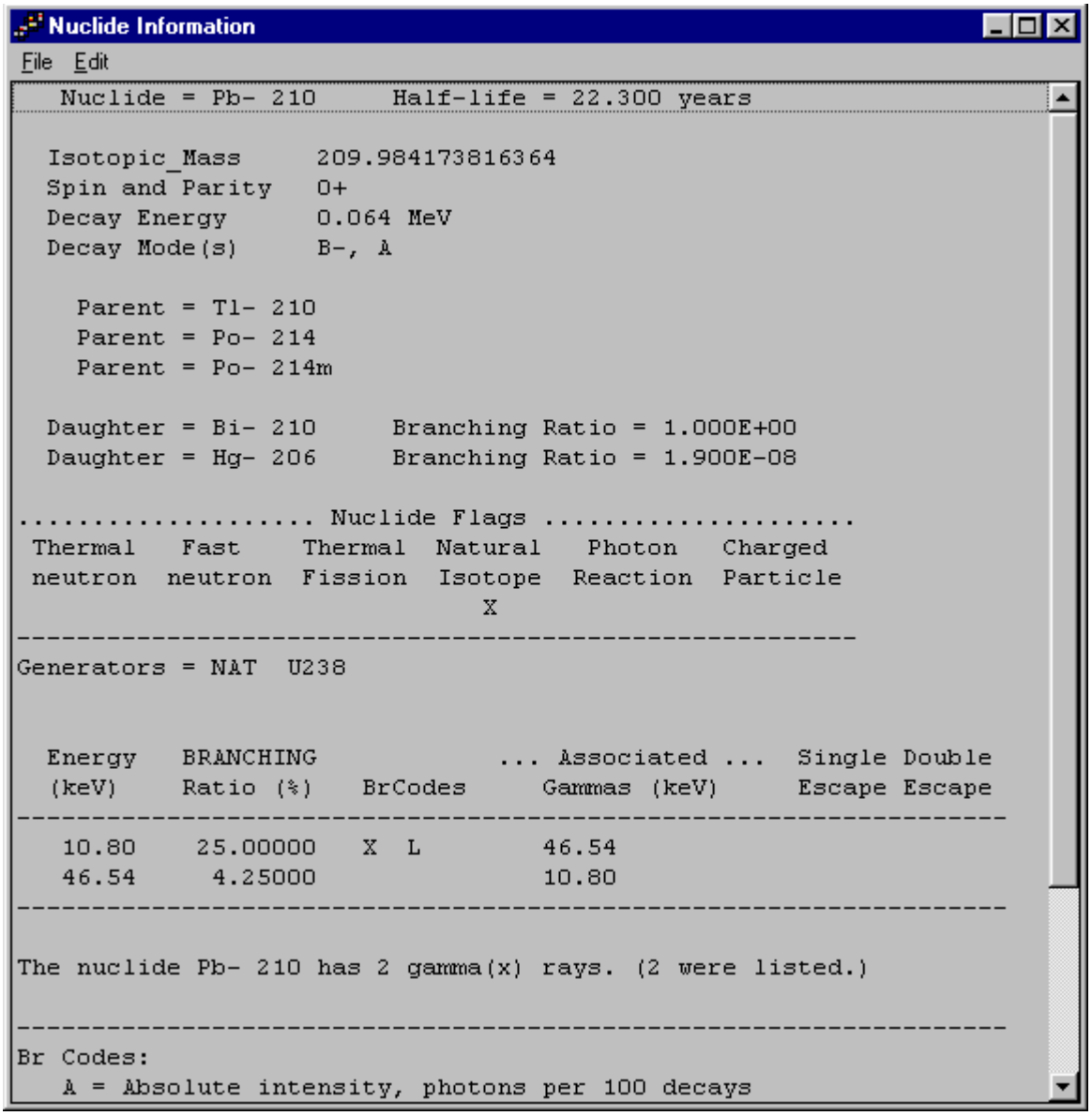

Fig. 14. Nuclide Information Displayed from the Listing Menu.

2.2.2. Options

The **Options** menu gives the choice of changing the number of gammas or alphas shown on the display. The options are **All**, **Top 5**, **Top 10**, **Top 15**, or **Top 20**.

2.2.3. Specific Activity...

This shows the specific activity for the selected element as shown in Fig. 15. The upper field shows the specific activity (Ci/g) for the naturally occurring element (shown here for lead). The lower field displays the specific activity for the selected single isotope of the element (shown here

for ^{209}Pb). To show the single isotope value, use the drop-down list to select from the valid atomic numbers, then click on **compute**.

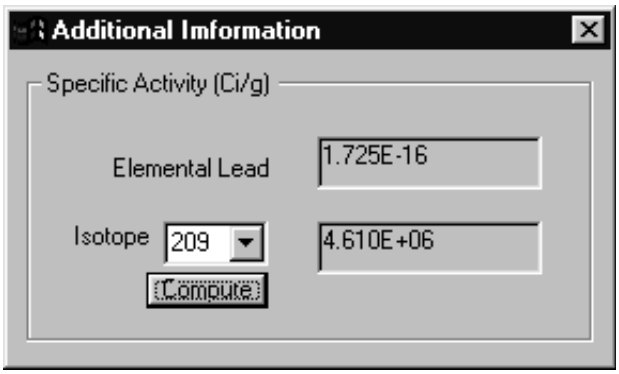

Fig. 15. Specific Activity for the Selected Element.

3. SEARCHING

To help identify the nuclide producing a gamma ray or alpha ray by energy, the library search can quickly display all the gammas (or alphas) and nuclides meeting the search. In addition, the half-life and the branching ratios of the selected energy along with the energies and branching ratios of two associated emissions are shown. The report can be printed or saved to disk. The search option is available only for the Source Library, but any library can be selected to be the source.

3.1. Unknown Gamma Ray Identification

To specify the constraints used in the search, click on the **Library Search** toolbar button (Fig. 16) to display the gamma-ray search dialog box (Fig. 17). To select an alpha-ray search, click on the **Search for...** menu item. The drop down menu will show a check in front of Gamma. Selecting Alpha will show Fig. 18 to specify the search for alpha rays.

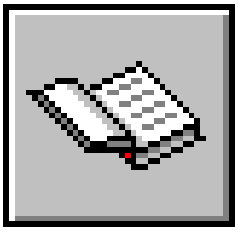

Fig. 16. Library Search Toolbar Button.

There are four limits that can be specified when trying to identify an "unknown": energy and range, half-life range, method of nuclide generation, and associated lines.

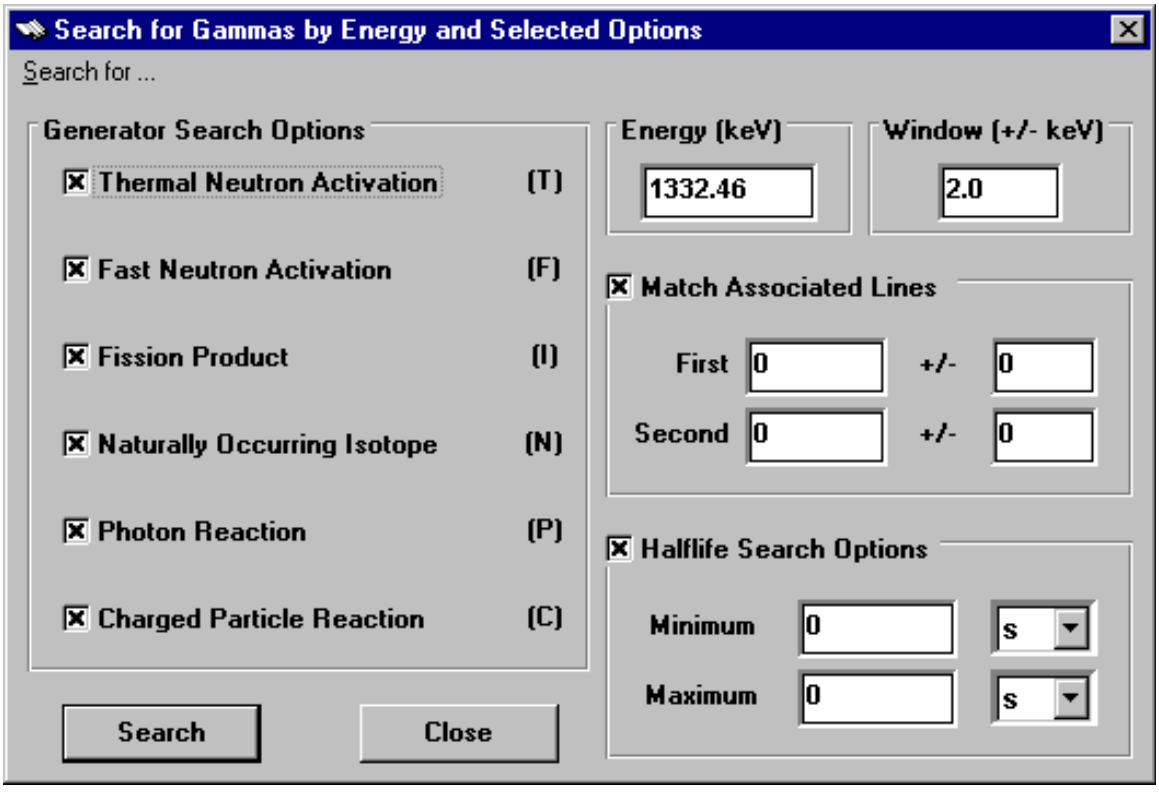

Fig. 17. Search Dialog Box.

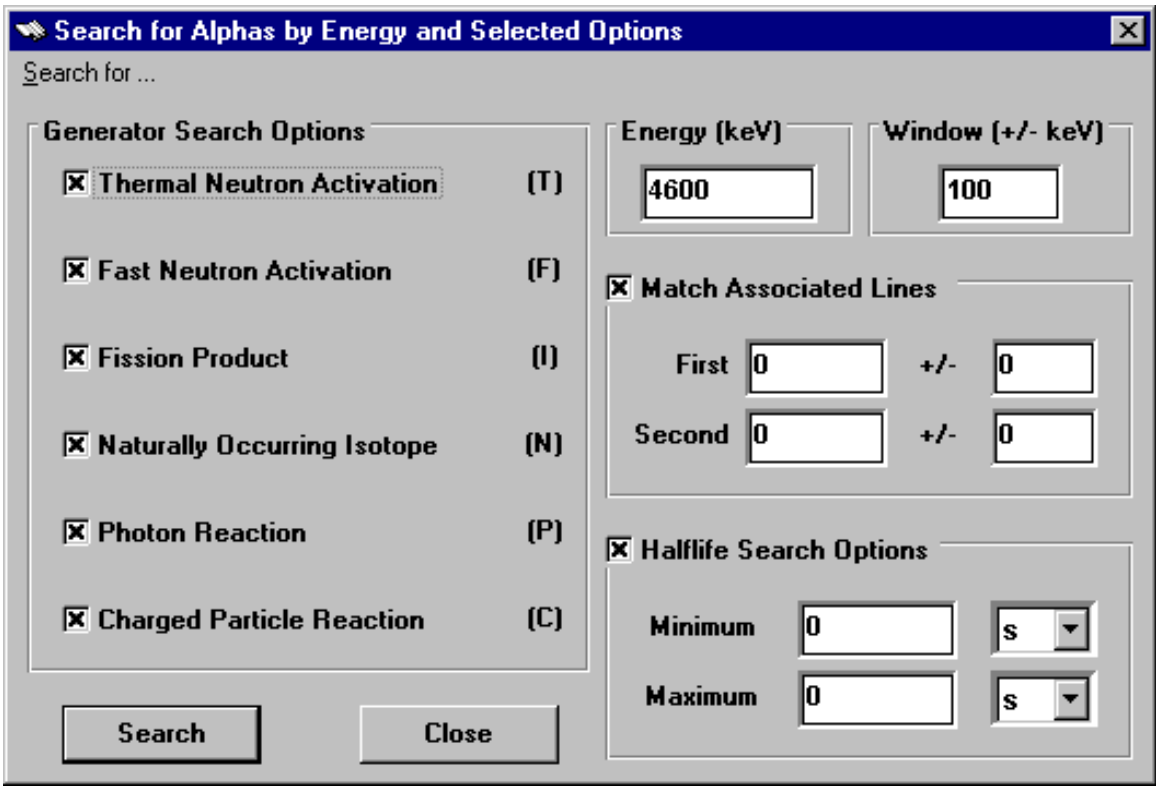

Fig. 18. Search for Alpha Rays.

3.1.1. Energy and Range

The energy range limit is specified using the **Energy (keV)** and **Window (+/– keV)** entries of the Search Dialog Box. These entries are in the upper-right corner of the Search Dialog Box (Fig. 17). The **Energy (keV)** entry specifies the selected energy. The **Window (+/– keV)** entry is used to specify the estimated range in the known gamma-ray or alpha-ray energy. Thus, to find a gamma ray that appears at 1331 keV in a given spectrum where energy calibration is uncertain by 0.2 keV, the values for the **Energy (keV)** and **Window (+/– keV)** entries would be 1331 keV and 0.2 keV, respectively. The defaults for alpha are larger than for gamma.

3.1.2. Half-Life Range

The half-life limits are located on the lower-right side of the Search Dialog Box (Fig. 17). A half-life limit can be used to eliminate nuclides that could not be present in the sample because they have too long or too short half-lives. Only nuclides with half-lives between the limits are included in the search results. For example, to identify a gamma ray from a sample that is over 100 days old, a minimum half-life value of 10 days or greater could be entered as a limit. This limit would be useful because any isotope with less than a 10-day half-life would have, for all practical purposes, completely decayed away after 100 days. Likewise, to look for a short-lived isotope, a maximum half-life limit could be specified. A half-life range can always be selected by specifying both a lower and an upper half-life limit.

To disable the half-life search limit completely, uncheck the **Half-life Search Options** check box, or set both values to zero.

3.1.3. Match Associated Lines

This will select from the primary search results only those nuclides that also have the second (and third) gamma ray energies specified. This is very helpful in spectrum analysis to reduce the nuclide lists to those which fit the spectrum.

3.1.4. Method of Nuclide Generation

The nuclide-generation constraints are located on the left side of the Search Dialog Box (Fig. 18). The **Generator Search Options** will limit the nuclides displayed to the type or types selected. The generation options and their abbreviations are:

- Thermal Neutron Activation (T)
- Fast Neutron Activation (F)
- Fission Product (I)
- Naturally Occurring Isotope (N)
- Photon Reaction (P)
- Charged Particle Reaction (C)

Examples of using the generation constraints are the following:

1) If a sample came from a reactor facility, check the **Fission Product** box (I), the **Thermal Neutron Activation** box (T), and maybe even the **Fast Neutron Activation** box (F). This will result in only gamma rays from nuclides produced by these reactions being reported.

2) If the sample came from an accelerator laboratory, check the **Photon Reaction** box (P) and **Charged Particle Reaction** box (C) options as well.

Clearly, the more that is known about a sample, the easier it will be to identify it. If the history of the sample is not known, check all options to ensure that all nuclides and gamma rays will be reported.

3.2. Search Results

Once the constraints are specified for the search, click on the **Search** button. NuclideNavigator will then begin searching the database for nuclides that meet the selected constraints for the unknown. A dialog box with a progress indicator will appear showing what percentage of the search is complete. Once the search is completed, the results will be presented in a text window.

An example of one such search is shown in Fig. 19. At the top of the output screen, the parameters of the search are given. As shown in Fig. 19, the search listed gamma rays with energies from 1332.26 keV to 1332.66 keV, with a minimum half-life of one day, produced by either thermal or fast neutron activation. Following the search options is the list of gamma rays matching the search constraints.

The uses of the columns in the gamma ray listing are as follows:

Gamma Ray	Energy of the gamma ray (keV)
Br Ratio	Decay branching ratio for this gamma ray
Nuclide	Nuclide that produces this gamma ray
Half Life	Half-life of the given nuclide
Gen.	Generation mechanisms for the given nuclide
1st Assoc. Gamma	First associated gamma of the given gamma ray
Br Ratio	Decay branching ratio of the first associated gamma ray
2nd Assoc. Gamma	Second associated gamma ray of the given gamma ray
Br Ratio	Decay branching ratio of the second associated gamma ray

The associated gamma rays are used to indicate other gamma rays that should be in the spectrum if the unknown gamma ray is from the listed nuclide. A potential gamma ray match can be rejected if the associated gamma rays are not present.

The first associated gamma ray is the most intense gamma ray for this nuclide other than the one searched for (i.e., the energy in Column 1). The second associated gamma ray is the second most intense gamma ray for this nuclide other than the two already listed. If there are no other gamma rays, the energy is given as zero.

If **Match Associated Lines** is enabled, the associated line is one or the other of these two lines. The results of the search can be saved to a file or printed out. You can access these options from the **File** menu of the output screen.

```
SEARCH CRITERIA:
       Gamma Energy = 1332.26 keV  -  1332.66 keV
       Associated line(s) = unbounded
     Half Lives = unbounded
       Generators = unbounded
```

Gamma Ray	Br Ratio	Nuclide	Gen	Half Life	1st Assoc. Gamma	Br Ratio	2nd Assoc. Gamma	Br Ratio
1332.310	1.5E-03	Ir- 186	C	16.6 h	296.893	6.4E-01	63.001	4.7E-01
1332.330	1.2E-02	Nb- 89m	C	114 m	511.000	1.5E+00	15.775	9.3E-02
1332.331	2.8E-03	Bi- 206	C	6.24 d	803.105	9.9E-01	881.015	6.6E-01
1332.440	8.8E-04	Ta- 173	C	3.14 h	55.790	6.0E-01	7.900	4.9E-01
1332.501	1.0E+00	Co- 60	TF	5.27 a	1173.237	1.0E+00	826.289	7.6E-05
1332.501	2.4E-03	Co- 60m	TF	10.5 m	826.289	7.7E-05	2158.779	7.2E-06
1332.502	5.2E-04	Ho- 157		12.6 m	45.998	3.3E-01	279.970	2.2E-01
1332.502	5.5E-05	Yb- 167	FC	17.5 m	50.742	9.5E-01	7.180	6.2E-01
1332.515	2.8E-05	Cu- 66	TF	5.09 m	1039.202	7.4E-02	833.010	1.7E-03
1332.550	5.3E-03	Sr- 93	FI	7.42 m	590.238	6.8E-01	875.736	2.4E-01
1332.610	3.1E-03	Fr- 228		39.0 s	473.701	1.0E-01	474.001	7.6E-02
1332.631	1.1E-03	Ho- 155	C	48.0 m	45.998	4.0E-01	511.000	3.8E-01

Fig. 19. Gamma Ray Search Output Screen.

4. LIBRARY MANAGEMENT

NuclideNavigator also allows you to create application-specific libraries that can be used with GammaVision and other software. This chapter will explain how to create, modify, and print these user-created, application-specific libraries. At the end of this chapter a specific library management example is given.

The previous chapters have focused on using NuclideNavigator to display information via the Segrè Chart View. A limited number of library management functions can also be accomplished from within the Segrè Chart View. For example, a new Target Library can be created and nuclide information copied into the target from within the Segrè Chart View. A complete set of library management tools are contained in the Library Manager View of NuclideNavigator. This chapter will focus on how to manage a library from within the Library Manager. Those tasks that can also be completed in the Segrè Chart View are indicated.

4.1. Library Manager View

To enter the Library Manager View from the Segrè Chart View, select **Library Manager View** from the **Tools** menu. Alternately you can click on the **Library Manager** toolbar button (Fig. 20). Examples of the Library Manager View are shown in Fig. 21 and Fig. 22. To exit the Library Manager View, select the **Segrè Chart View** menu item from the **Options** menu found in the Source Library Window.

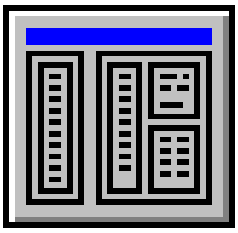

Fig. 20. Library Manager Toolbar Button.

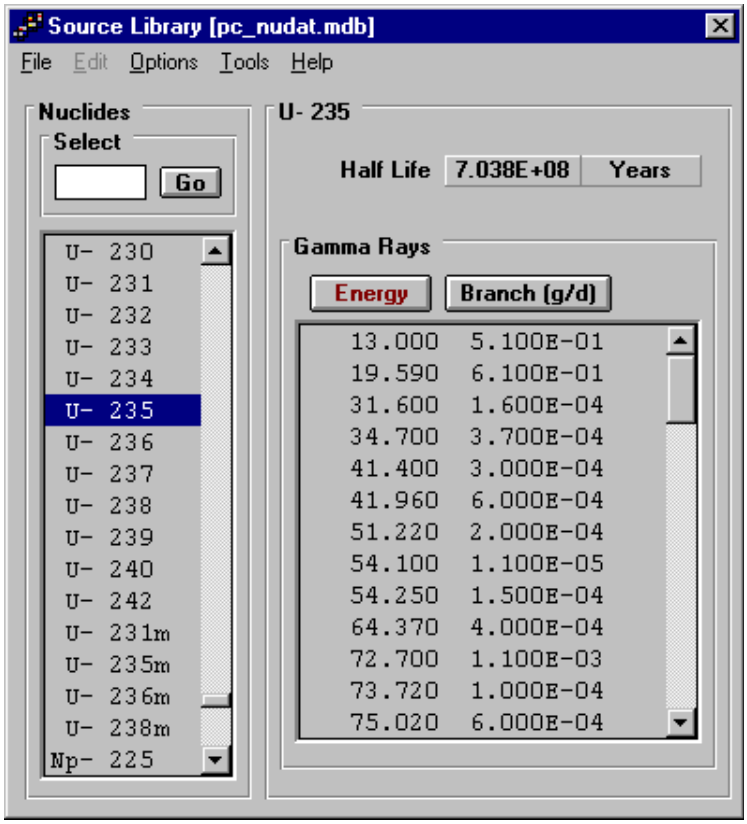

Fig. 21. Source Library Window.

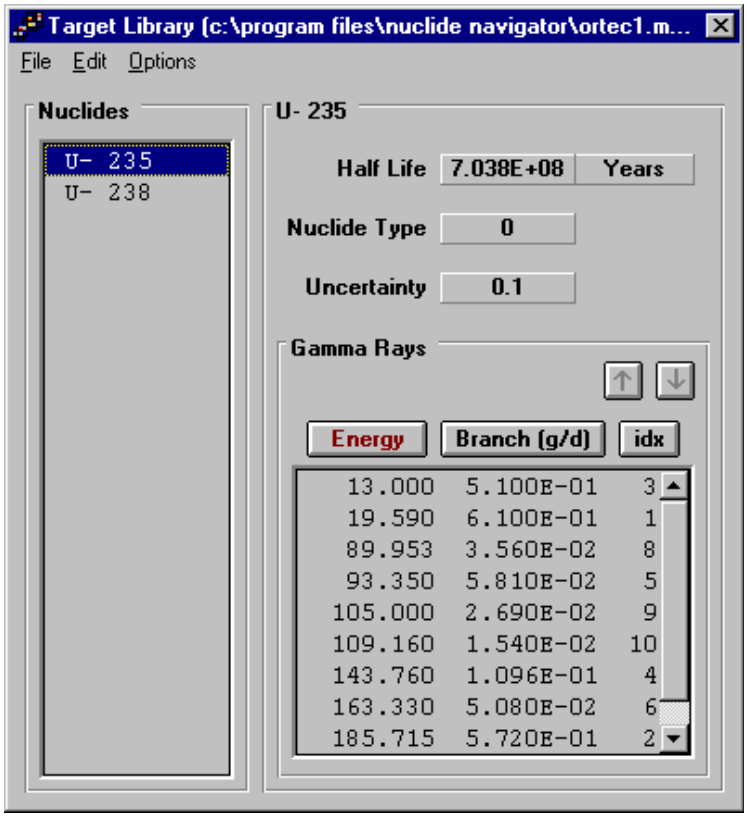

Fig. 22. Target Library Window.

In the Library Manager View there are two windows: one for the Source Library and one for the Target Library. The **Options** menu of both the source and target windows contains two settings that affect these windows. **Thin Window View** is useful to display a list of the nuclides in the library, or to conserve screen space. The Source Library window is the same as the Target Library window except that the Target Library window has Type and Uncertainty shown. You can link the source and target windows by checking the **Link Source & Target** menu item. When the windows are linked, both windows will move together when you drag either window around the screen (see Fig. 23). The wide view can show gammas, alphas, or betas as selected in the options.

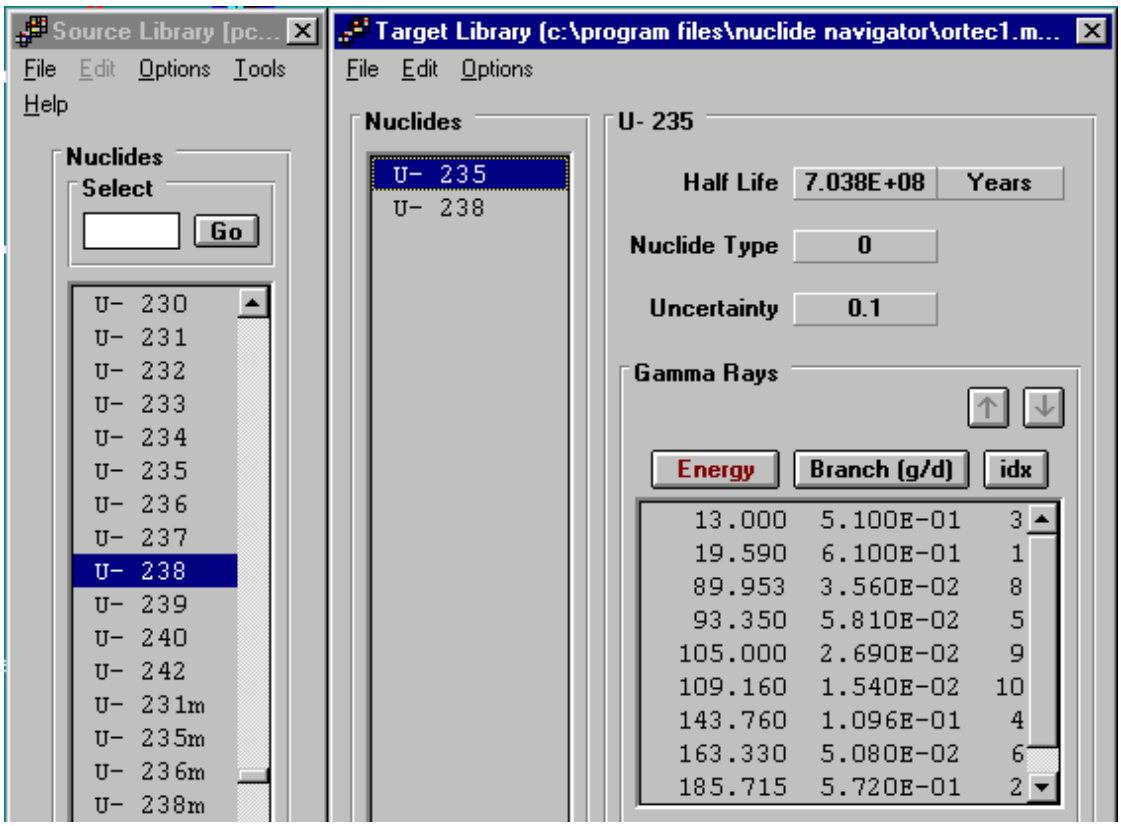

Fig. 23. Link Source and Target.

4.2. Library Creation

To create a new library in the Segrè Chart View, select **File**/**Open Target Library**. After this library has been created in either Access or GammaVision format, you can transfer nuclides, gamma rays, alphas and betas into it from either the Segrè **Pop-Up** menu or by selecting Library Manager View. You can select either an existing library or a new library for the Target Library. For existing libraries, the current contents are displayed.

If you select Library Manager without a target, a dialog opens so you can enter a Target Library name. To change libraries, use the **File**/**Open** command on the menu bar.

Six options affect the copying of nuclides and gamma rays:

- **Number to Copy**
- **Prompt Before Copy If No Gammas**
- **Prompt Before Copy If No Alphas**
- **Copy If Zero Branching Ratio**
- **Copy Escape Peaks**
- **Copy Daughter Nuclides**

These options are found in the target window's **Options** menu. The **Number to Copy** option allows you to select the number of gamma or alpha rays to copy from the total number of gamma rays listed for a nuclide in the Source Library. This option limits the number of gamma or alpha rays to the top 5, 10, 15, or 20 most intense gamma, alpha, or beta rays of a given nuclide. Limiting the number of gamma, alpha, or beta rays listed for a nuclide can be useful depending upon the application for which the library will be used. The **Prompt Before Copy If No Gammas** option can be set to verify the copying of a nuclide from the Source Library to the Target Library even if it has no gamma rays. This can also be set for alpha rays. The database used for the Source Master database contains gamma or alpha energies as reported by researchers. Sometimes the intensity of these are not known and are set to 0 in the database. Likewise for escape peaks, the intensity is not fixed. Neither of these should be used for activity calculations, and can be omitted from the Target Library by disabling the **Copy If Zero Branching Ratio** and **Copy Escape Peaks** options. **Copy Daughter Nuclides** will copy into the Target Library all the daughter nuclides and the gamma and alpha rays for these nuclides.

To display information about a nuclide in either the Source or Target Library, select that nuclide by clicking on it in the nuclide list box on the left side of the screen. When the nuclide is selected, its nuclide information and a list of its gamma rays are displayed to the right of the nuclide list box. (In "thin-window" mode, this information is not displayed.) The **File**/**Nuclide Information** menu item will display a text window listing information about the nuclide and its gamma rays.

To add nuclides to a Target Library, select a nuclide from the Source Library and drag it over to the Target Library's nuclide list box. Once the mouse is over the Target Library's nuclide list box, the list box will be highlighted and you can drop the nuclide in. In the Segrè Chart View use the **Copy Nuclide to Target Library** command on the **Pop-Up** menu to add a nuclide to the Target Library.

4.3. Library Modification

After transfer of the nuclides from the Source Library to the Target Library, the contents of the Target Library can be modified. NuclideNavigator allows you to add, delete or modify nuclide and

gamma-, alpha-, and beta-ray information. NuclideNavigator's own Master Libraries cannot be modified, but you can modify user-generated Source Libraries as well as any Target Library.

4.3.1. Adding a Nuclide

Choose the **Edit**/**Add Nuclide** menu option on the menu of the target window. When you select this command, a dialog opens allowing you to enter the nuclide symbol. Invalid nuclide symbols (e.g., *Cp* instead of *Co*) are rejected, and the valid nuclide symbols can be re-entered. Likewise, if the atomic weight for a nuclide does not match its atomic number, you must confirm the entry to verify that the weight is correct. Thus NuclideNavigator will try to ensure that only a valid nuclide symbol is entered, however, you can enter other values like ^{99}K.

After you have entered a nuclide symbol, NuclideNavigator will present a blank nuclide properties form (Fig. 24) for you to complete. This form contains input boxes for the nuclide's half-life, type, and uncertainty value, as well as check boxes for various nuclide flags. You must specify a valid half-life before NuclideNavigator will accept the data entered on this screen.

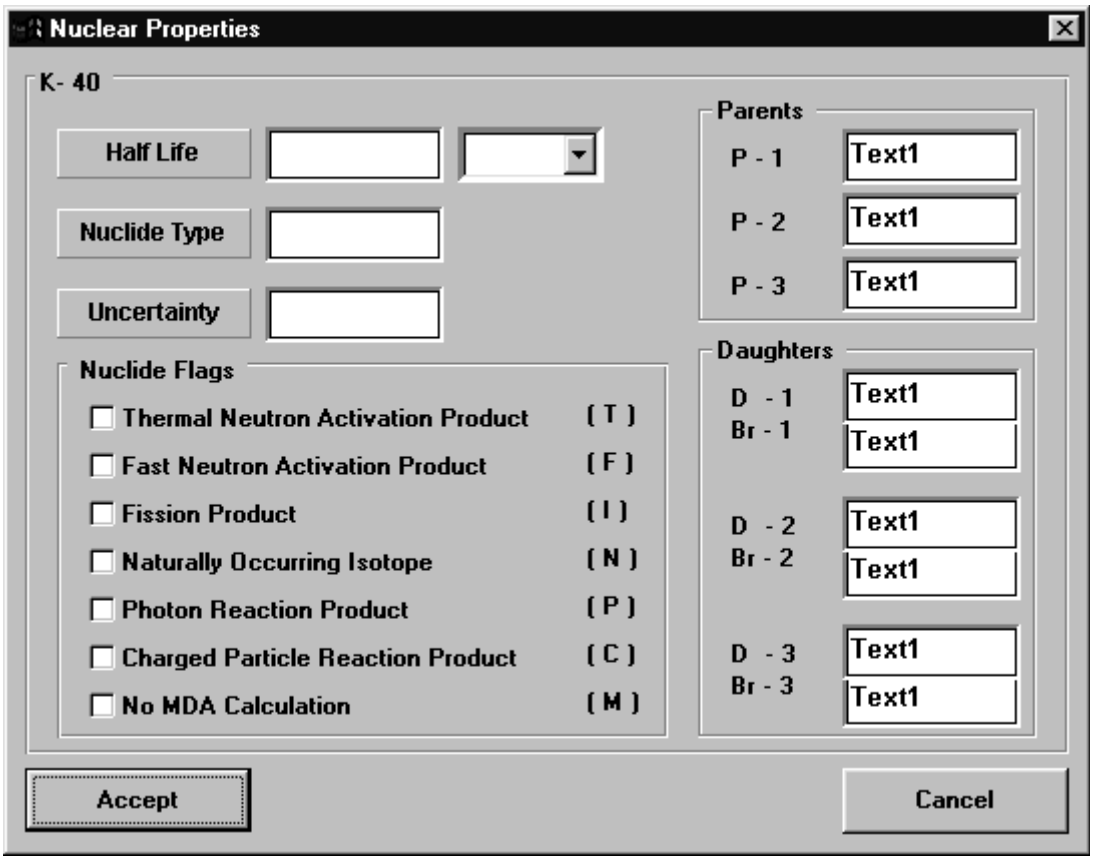

Fig. 24. Blank Nuclide Information Entry Form.

4.3.2. Deleting a Nuclide

To delete a nuclide, select a nuclide from the target window's nuclide list box. Once the nuclide is highlighted, the **Delete Nuclide** command on the **Edit** menu will be enabled. When you select **Delete Nuclide**, NuclideNavigator will ask you to verify the deletion of the nuclide and its gamma rays from the library. Answer **Yes** to delete the nuclide.

4.3.3. Editing Nuclide Properties

To edit a nuclide's properties, click on any field in the nuclide information display area. This will open the nuclide information form shown in Fig. 24. This is the same form used for adding a nuclide, however, instead of being blank, the form will contain the current information for the selected nuclide. By changing values on this form and accepting them, you can modify the nuclide information for any selected nuclide in the Target Library. You can also do this by highlighting the nuclide name and selecting **Edit/Edit nuclide** from the menu bar. The **Parents** and **Daughters** fields *must have valid isotope names*. The field **Br –** *i* (where *i* is 1, 2, or 3) is the branching ratio to the daughter **D –** *i*.

4.3.4. Adding Emissions

The type of emission (alpha, beta, or gamma) to add is the same as the type being displayed. This is selected in **Options/New Dialog**. The dialogs for changes are similar so only gamma will be discussed here.

To add a gamma ray for a given nuclide, first select the nuclide from the target window's nuclide list box. Once the nuclide is selected, the **Add Gamma Ray** command on the window's **Edit** menu is enabled. Select the **Add Gamma Ray** menu item to display the gamma ray information form (Fig. 25). Next, enter the **Energy** and branching ratio (**Branch**) for the gamma ray, and check the correct **Photon Flags** information. Once this is done, click on the **Accept** button to accept the new gamma ray information.

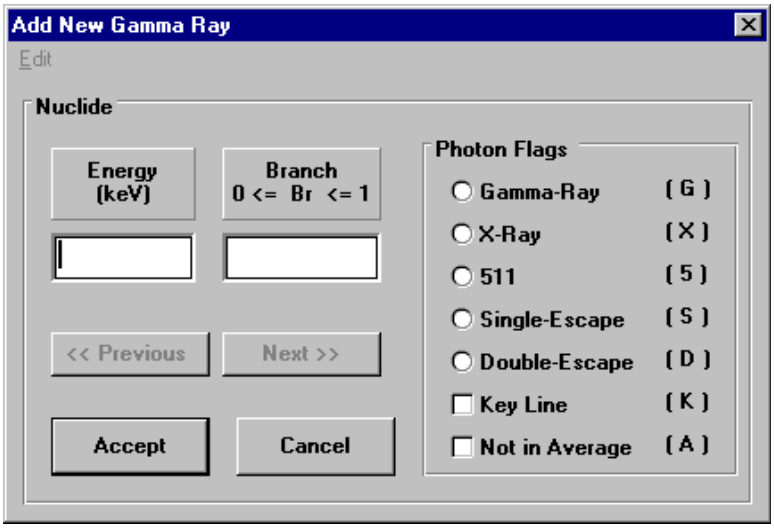

Fig. 25. Gamma Ray Information Form.

Note that when adding any emission, the **Next>>** and **<<Previous** buttons of the form are gray (inactive).

4.3.5. Deleting a Gamma Ray

Select the nuclide that has the gamma ray to be deleted, then select the gamma ray to be deleted, and choose the **Delete Gamma Ray** command. NuclideNavigator will ask you to verify the deletion of the gamma ray. Answer **Yes** to delete the gamma ray.

4.3.6. Modifying Gamma Ray Information

To modify a gamma ray's properties, double-click on a gamma ray in the target window gamma ray list box. This will open the gamma ray information form (Fig. 25), containing the given gamma ray's data. Change the information as needed then click on **Accept**. You can also modify the gamma rays by choosing a gamma ray and then selecting **Edit**/**Edit gamma ray** from the menu bar.

When modifying gamma-ray data, you can use the information form to navigate through all of a given nuclide's gamma rays. Use the **Next>>** and **<<Previous** buttons to display the complete list of a nuclide's gamma rays.

4.3.7. Reordering Gamma Rays

The master gamma rays are ordered in increasing energy. When transferred to a Target Library, this order is maintained. However, NuclideNavigator allows you to display the gamma rays in any order you wish, (e.g., in decreasing yield or branching ratio). To display the emissions list in ascending order, click on the **Energy** button as seen above the list in Fig. 23. To display the list in branching order, click on the **Branch (g/d)** button. To display the list in the user order click on the **idx** button. To change the order in the idx mode, use the up and down arrow buttons above the upper-right corner of the target window's gamma ray list box. These buttons change the order in which the gamma rays of a nuclide are listed in the GammaVision library. To use these arrows, first select a gamma ray and then click either the up or down arrow to move the gamma ray one position. If the gamma ray is at the top and/or bottom of the list the respective button is disabled.

4.4. Library Reporting

NuclideNavigator can generate four different reports or lists of the library contents. These reports are generated based on the **Print Method** settings. The first setting selects either (1) the printing of all of the nuclide information first, then the emission information; or (2) a nuclide followed by its emission information, and then the next nuclide and its emission information and so on. The second setting selects the emission lists to be printed either sorted by energy or branching ratios. These are set by the **Options, View/Print** menu. Selecting **View/Print** will open the next menu. The current report settings of NuclideNavigator are shown with check marks. To change the options, select the desired option in the menu.

Figs. 26, 27, 28, and 29 illustrate the four types of report formats that can be generated and what settings were used to create these formats.

Library SRM4275.MDB has 3 nuclides and 24 gamma rays:

Isotope	Halflife	Uncertainty	Flags
Sb- 125	2.77E+00 y	0.10	#NULL#
Eu- 154	8.50E+00 y	0.10	#NULL#
Eu- 155	4.96E+00 y	0.10	#NULL#

Energy (keV)	Branch Ratio (g/d)	Isotope	Flags
123.10	4.046E-01	Eu- 154	
1274.80	3.550E-01	Eu- 154	
86.45	3.274E-01	Eu- 155	
427.95	2.960E-01	Sb- 125	
105.31	2.180E-01	Eu- 155	
723.30	1.970E-01	Eu- 154	
600.77	1.840E-01	Sb- 125	
1004.80	1.760E-01	Eu- 154	
873.20	1.130E-01	Eu- 154	
636.15	1.120E-01	Sb- 125	
996.30	1.070E-01	Eu- 154	
463.51	1.000E-01	Sb- 125	
248.04	6.600E-02	Eu- 154	
176.29	6.300E-02	Sb- 125	
35.46	5.800E-02	Sb- 125	
606.82	5.200E-02	Sb- 125	
591.70	4.600E-02	Eu- 154	
756.70	4.100E-02	Eu- 154	
671.66	1.800E-02	Sb- 125	
1597.30	1.700E-02	Eu- 154	
692.50	1.650E-02	Eu- 154	
380.51	1.400E-02	Sb- 125	
45.30	1.355E-02	Eu- 155	
60.01	1.211E-02	Eu- 155	

Fig. 26. Example 1.

Library SRM4275.MDB has 3 nuclides and 24 gamma rays:

Isotope	Halflife	Uncertainty	Flags
Sb- 125	2.77E+00 y	0.10	#NULL#
Eu- 154	8.50E+00 y	0.10	#NULL#
Eu- 155	4.96E+00 y	0.10	#NULL#

Energy (keV)	Branch Ratio (g/d)	Isotope	Flags
35.46	5.800E-02	Sb- 125	
45.30	1.355E-02	Eu- 155	
60.01	1.211E-02	Eu- 155	
86.45	3.274E-01	Eu- 155	
105.31	2.180E-01	Eu- 155	
123.10	4.046E-01	Eu- 154	
176.29	6.300E-02	Sb- 125	
248.04	6.600E-02	Eu- 154	
380.51	1.400E-02	Sb- 125	
427.95	2.960E-01	Sb- 125	
463.51	1.000E-01	Sb- 125	
591.70	4.600E-02	Eu- 154	
600.77	1.840E-01	Sb- 125	
606.82	5.200E-02	Sb- 125	
636.15	1.120E-01	Sb- 125	
671.66	1.800E-02	Sb- 125	
692.50	1.650E-02	Eu- 154	
723.30	1.970E-01	Eu- 154	
756.70	4.100E-02	Eu- 154	
873.20	1.130E-01	Eu- 154	
996.30	1.070E-01	Eu- 154	
1004.80	1.760E-01	Eu- 154	
1274.80	3.550E-01	Eu- 154	
1597.30	1.700E-02	Eu- 154	

Fig. 27. Example 2.

Library SRM4275.MDB has 3 nuclides and 24 gamma rays:

Sb- 125 Halflife: 2.77E+00 y Uncertainty: 0.10 Flags:

Energy (keV)	Branch Ratio (g/d)	Flags
35.46	5.800E-02	#NULL#
176.29	6.300E-02	#NULL#
380.51	1.400E-02	#NULL#
427.95	2.960E-01	#NULL#
463.51	1.000E-01	#NULL#
600.77	1.840E-01	#NULL#
606.82	5.200E-02	#NULL#
636.15	1.120E-01	#NULL#
671.66	1.800E-02	#NULL#

Eu- 154 Halflife: 8.50E+00 y Uncertainty: 0.10 Flags:

Energy (keV)	Branch Ratio (g/d)	Flags
123.10	4.046E-01	#NULL#
248.04	6.600E-02	#NULL#
591.70	4.600E-02	#NULL#
692.50	1.650E-02	#NULL#
723.30	1.970E-01	#NULL#
756.70	4.100E-02	#NULL#
873.20	1.130E-01	#NULL#
996.30	1.070E-01	#NULL#
1004.80	1.760E-01	#NULL#
1274.80	3.550E-01	#NULL#
1597.30	1.700E-02	#NULL#

Eu- 155 Halflife: 4.96E+00 y Uncertainty: 0.10 Flags:

Energy (keV)	Branch Ratio (g/d)	Flags
45.30	1.355E-02	#NULL#
60.01	1.211E-02	#NULL#
86.45	3.274E-01	#NULL#
105.31	2.180E-01	#NULL#

Fig. 28. Example 3.

Library SRM4275.MDB has 3 nuclides and 24 gamma rays:

Sb- 125 Halflife: 2.77E+00 y Uncertainty: 0.10 Flags:

Energy (keV)	Branch Ratio (g/d)	Flags
427.95	2.960E-01	#NULL#
600.77	1.840E-01	#NULL#
636.15	1.120E-01	#NULL#
463.51	1.000E-01	#NULL#
176.29	6.300E-02	#NULL#
35.46	5.800E-02	#NULL#
606.82	5.200E-02	#NULL#
671.66	1.800E-02	#NULL#
380.51	1.400E-02	#NULL#

Eu- 154 Halflife: 8.50E+00 y Uncertainty: 0.10 Flags:

Energy (keV)	Branch Ratio (g/d)	Flags
123.10	4.046E-01	#NULL#
1274.80	3.550E-01	#NULL#
723.30	1.970E-01	#NULL#
1004.80	1.760E-01	#NULL#
873.20	1.130E-01	#NULL#
996.30	1.070E-01	#NULL#
248.04	6.600E-02	#NULL#
591.70	4.600E-02	#NULL#
756.70	4.100E-02	#NULL#
1597.30	1.700E-02	#NULL#
692.50	1.650E-02	#NULL#

Eu- 155 Halflife: 4.96E+00 y Uncertainty: 0.10 Flags:

Energy (keV)	Branch Ratio (g/d)	Flags
86.45	3.274E-01	#NULL#
105.31	2.180E-01	#NULL#
45.30	1.355E-02	#NULL#
60.01	1.211E-02	#NULL#

Fig. 29. Example 4.

4.5. Example

In this example, we will build a GammaVision library containing three nuclides to illustrate how to enter the library management view, open a new Target Library, add/delete nuclides, add/delete gamma rays, and save the library.

Switch to the Library Management View

Do this by clicking on the **Library Manager** button (see Fig. 1) on the Segrè Chart's toolbar.

Open NuclideNavigator's Master Library as the Source Library (if it is not already open)

Choose **Open** from the Source Library window's **File** menu, then select the name of the Master Library from the file list.

Create a new NuclideNavigator Target Library

Choose **Open** from the Target Library window's **File** menu. The dialog box is shown in Fig. 30. Type **`ORTEC1.MDB`** in the **File Name** text box, then click on the **Open** button.

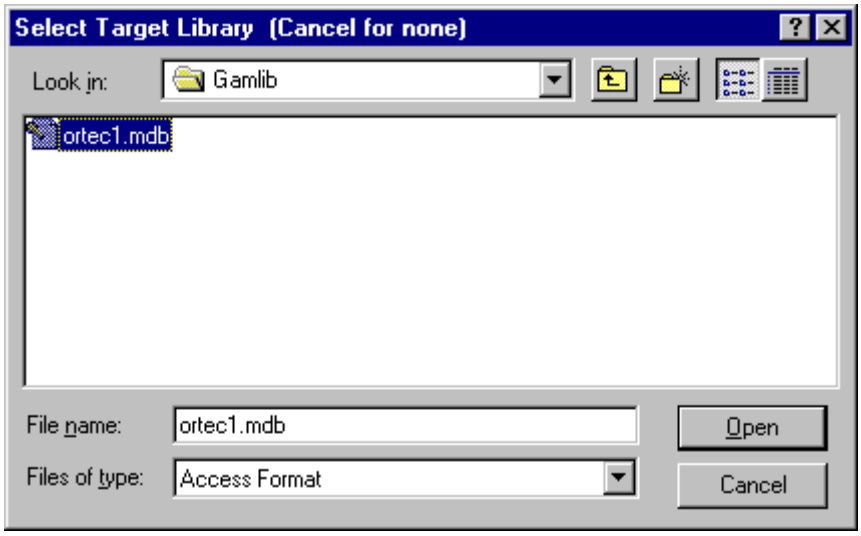

Fig. 30. Select Target Library.

After you click on the button, a blank Target Library window will be displayed on the screen. The source and target windows should look similar to those in Fig. 31.

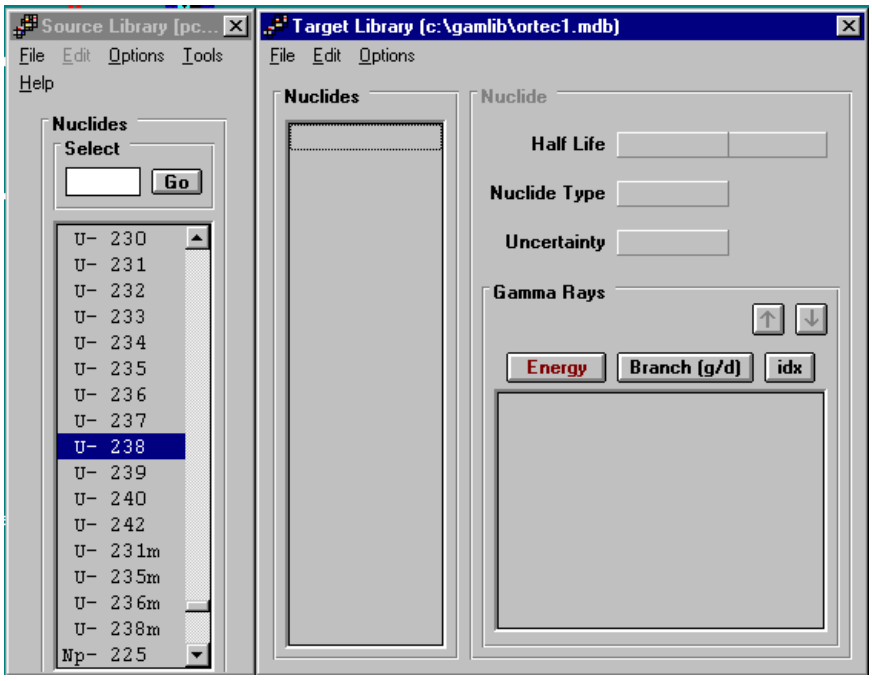

Fig. 31. Create Target Library Window.

Add nuclides to the Target Library

To add ^{60}Co to the Target Library, scroll down through the Master Library to show the ^{60}Co region from the Source Library nuclide list box (see Fig. 32) or enter Co60 in the **Go** box and click on **Go**. Put the mouse pointer on ^{60}Co, then press and hold the left mouse button. The pointer will change from an arrow to a sheet of paper. Without releasing the mouse button, drag ^{60}Co from the Source Library list box to the Target Library nuclide list box. When the cursor is over the target's nuclide list box, the list box will be highlighted (see Fig. 33). Now release the mouse button; the pointer will return to an arrow shape.

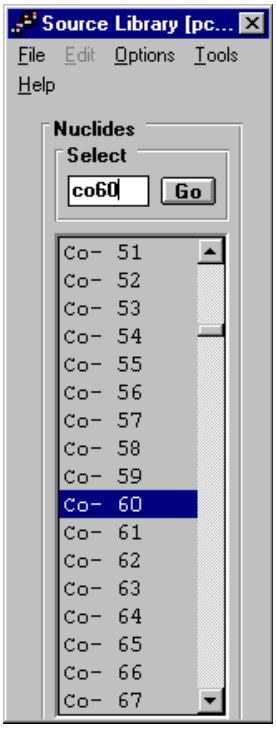

Fig. 32. Source Library Nuclide List Box.

Follow the same procedure to add ^{138}Cs. Next add ^{137}Cs.

NuclideNavigator will display warning messages if the selected nuclides do not have any gamma, X, or alpha rays.

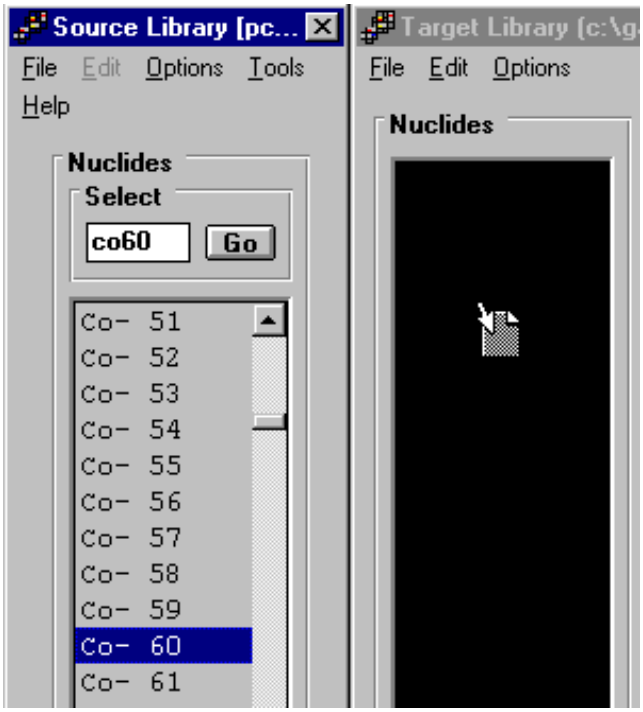

Fig. 33. Target Library Nuclear List Box.

Deleting a nuclide from the Target Library

Suppose that we added ^{138}Cs to the library in error, so it must be deleted. To delete ^{138}Cs, click on it in the Target Library window, as illustrated in Fig. 34.

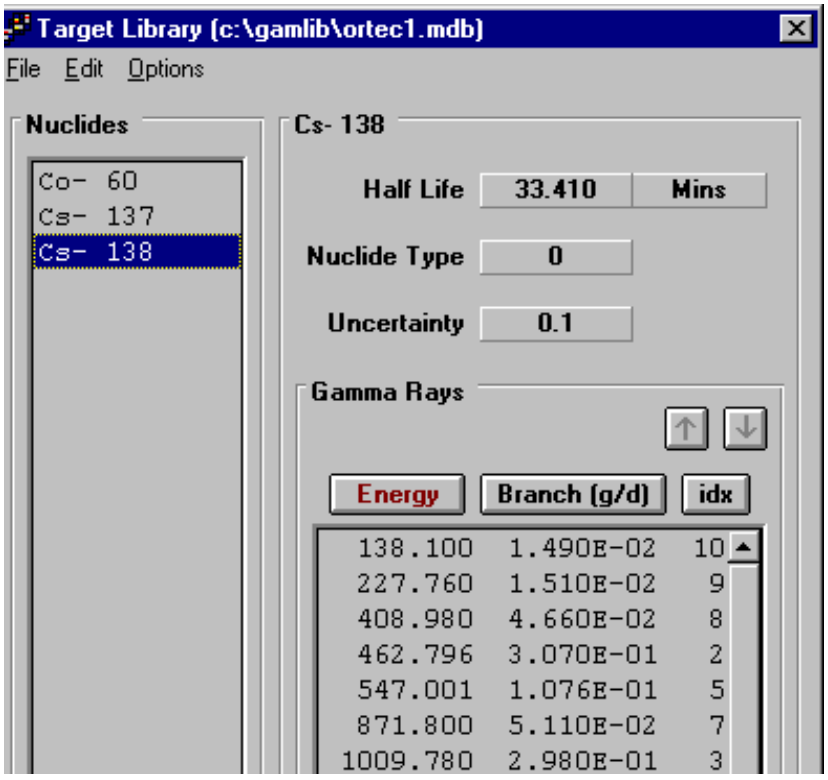

Fig. 34. Target Library Window.

Now select **Edit/Delete Nuclide** from the menu bar. The dialog shown in Fig. 35 will ask you to confirm the deletion of ^{138}Cs. Click on **Yes**.

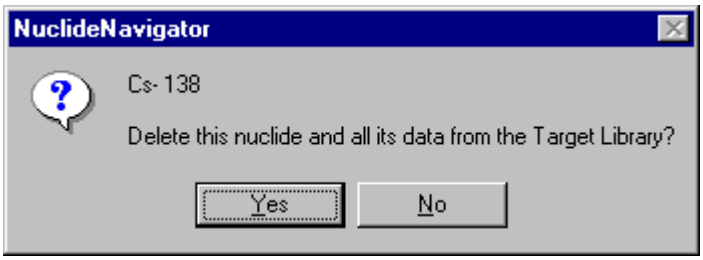

Fig. 35. Confirm Deletion of Nuclide.

Deleting gamma rays

To delete a gamma ray, first select the nuclide, then select the gamma ray to be deleted. Click on ^{137}Cs. This will display all of the ^{137}Cs gamma rays. Next click on the 37.60 keV gamma ray shown in the gamma ray list box, as shown in Fig. 36.

Now select **Edit/Delete Gamma Rays** from the Target Library menu bar. This opens the dialog to confirm the deletion of the 37.60 keV gamma ray. Click on **Yes** to delete.

Now select ^{60}Co and delete all but two of its gamma rays.

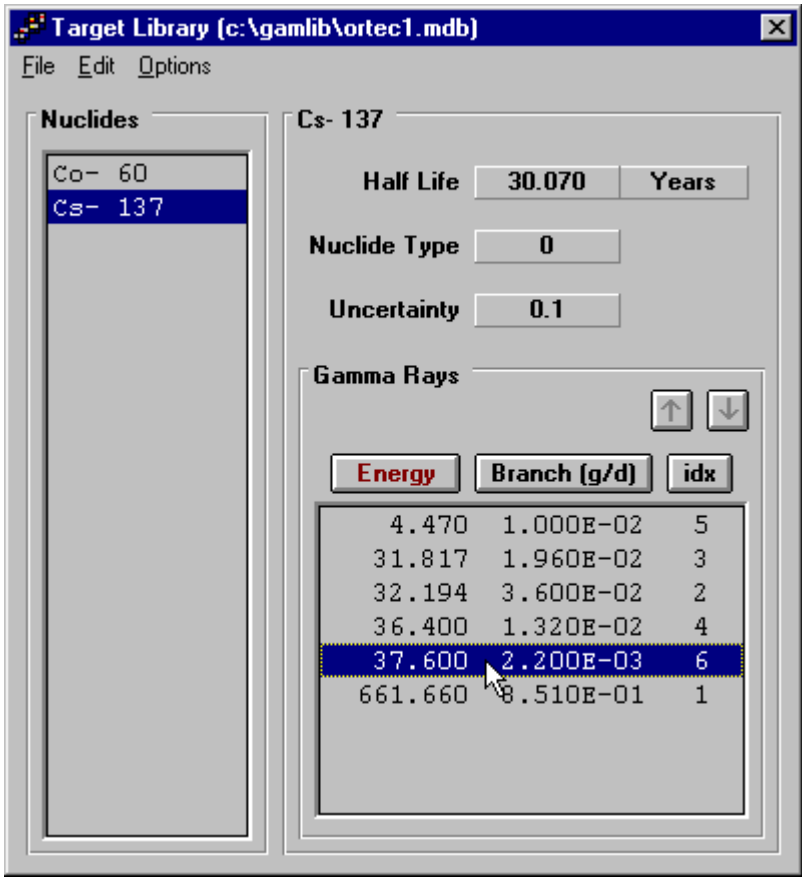

Fig. 36. Deletion of Gamma Ray.

Adding a nuclide manually

To add a nuclide choose **Edit/Add Nuclide...** from the target window's menu to open the dialog for entering a nuclide symbol and atomic number (see Fig. 37). Assume that ^{137m}Cs has been discovered and it is to be added to the Target Library: Enter ^{137m}Cs and click on the **Accept** button.

The blank nuclide properties form will be displayed as shown in Fig. 24, page 23. Enter the following information: **0.123** seconds for the half-life, **0** for the nuclide type, and **0.123** for the nuclide uncertainty. In addition to these text fields, you can set several flags for the nuclide by marking the check boxes shown. Check the fast neutron activation box. Now click on the **Accept** button.

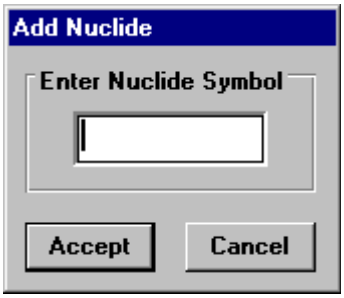

Fig. 37. Add Nuclide.

Adding a gamma ray manually

At this point, ^{137m}Cs has no gamma rays, so the next step is to add its gamma rays. Make sure that ^{137m}Cs is selected and then choose **Edit**/**Add Gamma Ray...** from the Target Library window's menu. The blank Add New Gamma Ray form will then be displayed. ^{137m}Cs has two gamma rays, one at 1234 keV and the other at 2345 keV. The Add New Gamma Ray form with the 1234-keV gamma ray information is shown in Fig. 38. Note that the value 1234 has been entered in the **Energy** field, .1234 has been entered as the branching ratio, and the **Gamma Ray** Photon Flag has been marked.

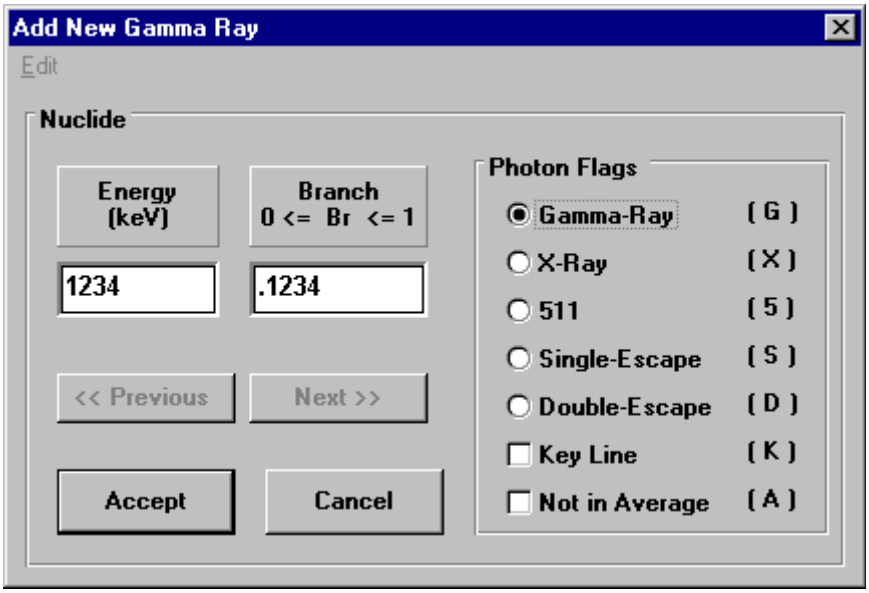

Fig. 38. Add New Gamma Ray Form.

Repeat the same steps to enter a 2345-keV gamma ray for ^{137m}Cs. Enter .2345 as the branching ratio for the 2345-keV gamma ray. Check the **Gamma Ray** Photon Flag. After both of these gamma rays have been entered, the gamma ray list box for ^{137m}Cs should look like Fig. 39.

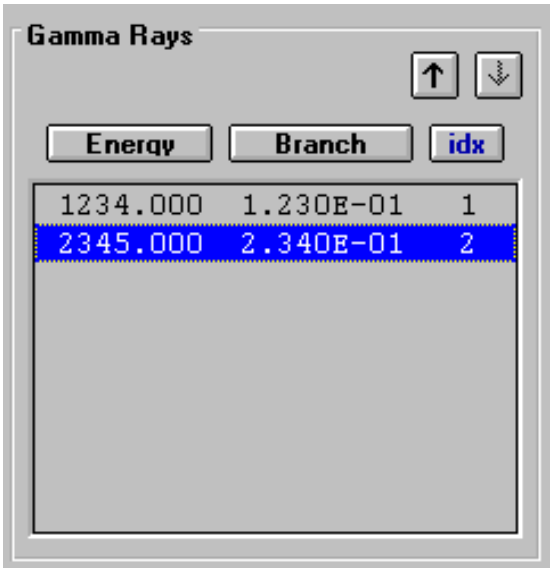

Fig. 39. Gamma Ray List Box.

The **Gamma Rays** display can show the list ordered by energy, branching ratio, or index. To show the list ordered by branching ratio, click on the **Branch** button; likewise for **Energy** or **idx**. The index number can be changed to order them in the desired order. To rearrange the index order, click on **idx** then click on an energy. Now click on the up or down arrow to

move the selected gamma ray in the list. This indexing is used when libraries are saved in the GammaVision library format.

Saving a library in GammaVision format

To save the library in GammaVision format, choose **File/Save As/GammaVision...** from the Target Library menu. This will open the dialog shown in Fig. 40. Enter the name for the library and click on **Save**.

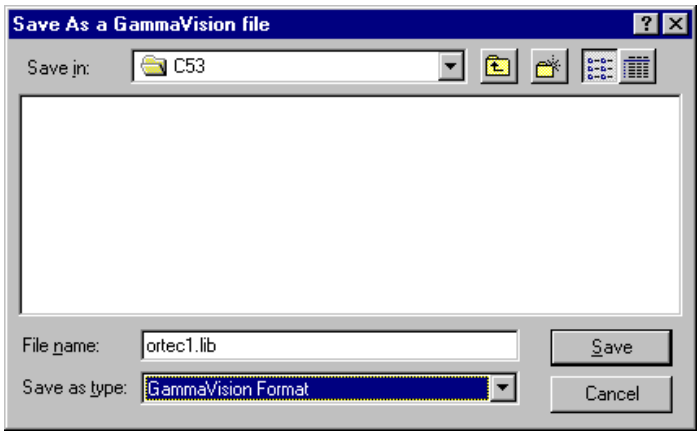

Fig. 40. Save A Library.

Since GammaVision libraries can allocate more space than is needed for the actual nuclide and gamma ray information in the library, the actual allocation values can be specified. Since some gamma rays were deleted in our example, the actual gamma ray count for the example library is eight. The allocation prompt form is shown in Fig. 41. After entering the values desired (or accepting the default values), press the **OK** button to continue.

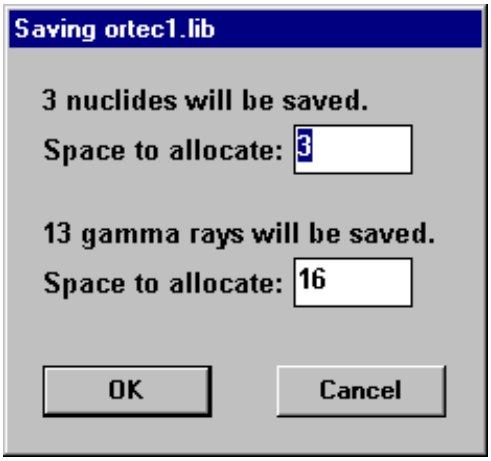

Fig. 41. Allocation Prompt Form.

5. APPLICATION LIBRARIES

Several application libraries are supplied for convenience. The nuclides chosen come from various sources including IAEA, NCRP, ICRP, the USNRC, and other laboratories. These application libraries are intended as starting points for the building of individual analysis libraries for these applications. Use these libraries as is, or modify them to meet individual requirements.

These libraries are subsets of the **MASTER.MDB** file. The ordering of the peaks for each nuclide has been modified as necessary for each application. The half-life of some nuclides has been changed to that of the parent nuclide to account for transient or secular equilibrium. Some nuclide names in the application libraries can be modified as discussed in each section below.

5.1. NATURAL.LIB

Natural Radionuclide Library

This library contains each of the three naturally-occurring decay series (^{238}U, ^{232}Th, and ^{235}U), in decreasing atomic mass order. Each nuclide in a particular subseries within each decay series has been assigned the half-life of the parent of that subseries. By examining the agreement of activity between nuclides of the subseries, information regarding equilibrium can be obtained. This library can be used with natural samples in which transient and secular equilibrium is assumed or is being tested.

5.2. NPP.LIB

Nuclear Power Plant Library

This library contains gamma rays for fission and activation products, and naturally-occurring nuclides with large branching ratios. The inclusion of these naturally-occurring photopeaks is based on the ambient background measurements. Nuclides involved in beta decay with transient equilibrium (such as ^{106}Rh, whose photopeaks are used to quantify ^{106}Ru) have had their nuclide name and half-life changed. You may wish to edit the nuclide names preferred. This library can also be used for EBAR, IEQ, and MPC calculations.

5.3. FOOD.LIB

Food Library

This library is created from a list of isotopes taken directly from the 1989 IAEA technical report series #295, *Measurements of Radionuclides in Food and the Environment, A Guidebook*.

5.4. NAC.LIB

Neutron Activation Library

This library is suitable for neutron activation analysis where the decay gamma rays are being measured. Only nuclides with a half-life greater than 10 hours are included in this library. You can copy this library and then delete additional shorter-lived nuclides to create a library better suited for measurement of long-lived nuclides. If very short-lived activity is to be measured, you may wish to build a library of short-lived radionuclides using the **PC_NUDAT.MDB** Master Library. Nuclides that are produced by nuclear reactions other than single (n,γ) reactions have been renamed with the product nuclide names. For example, ^{58}Co is used to measure Ni and is named ^{58}Co.

5.5. DET.LIB

Detector Library

This library contains radionuclides found in the ambient environment of most laboratories. It is useful in the creation of the PBC correction file. By analyzing a background spectrum against this library and a specific efficiency calibration, the PBC values can be determined.

5.6. SUSPECT.LIB

Suspected Nuclide Library

From this library, a suspected nuclide or MAESTRO® library can be created which contains up to five significant peaks for each nuclide in **ENSDF.LIB**. Except for naturally-occurring nuclides, only those nuclides with a half-life greater than 10 hours are included. Transuranic nuclides are omitted from **SUSPECT.LIB**. Also useful for analyzing an unknown sample for the first time, this library includes the annihilation peak at 511 keV (ANN-511) and the lead x-ray peaks (PBKA and PBKB).

5.7. CALIBRATION LIBRARIES

These libraries are provided for calibration of the gamma-ray spectroscopy system for energy, shape, and efficiency. Low-yield peaks have been omitted from these libraries.

5.7.1. MIXCLB.LIB

Mixed Radionuclides

This library contains the radionuclides provided in the most common mixed radionuclide sources commercially available. This library may contain one or two radionuclides not present

in a particular source; for example, ^{241}Am is not included in all varieties of this source. Delete any additional nuclides from a copy of this library for particular calibrations.

The nuclide list includes:

^{241}Am	^{109}Cd	^{57}Co	^{139}Ce	^{203}Hg	^{113}Sn
^{133}Ba	^{85}Sr	^{137}Cs	^{88}Y	^{60}Co	

5.7.2. SRM4275.LIB

Mixed ^{154}Eu, ^{155}Eu, and ^{125}Sb

This library is suitable for use with the National Institute of Standards and Technology (NIST) Standard Reference Material (SRM) 4275 and 4276. SRM-4275 is a point source, and SRM-4276 is a liquid source. Information regarding the availability and use of this source can be obtained from NIST, Office of SRMs, Bldg. 222, Room B-311, Gaithersburg, MD, USA 20878-9950.

5.8. PROMPT GAMMA LIBRARY

Prompt gamma rays from thermal-neutron capture in natural elements will be found in this library. These typically high-energy gamma rays are emitted coincident with the neutron-capture and are not associated with the alpha- and beta-decay processes that are normally measured with the decay gamma rays. This library is intended for analytical high-resolution prompt gamma-ray neutron activation analysis and other applications involving prompt gamma-ray measurements.

Lone, Leavitt and Harrison Library — LLHPG.LIB

The prompt gamma-ray master library, **`LLHPG.LIB`**, is taken from *Prompt Gamma Rays from Thermal Neutron Capture*, and is used with permission of the author. The original data included 83 nuclides and 10200 photopeaks. Gamma rays with less than 0.1% (0.001) gammas per disintegration (branching ratio) were deleted; the library file **`LLHPG.LIB`** contains 83 nuclides and 8181 peaks. The half-life for all nuclides is set to 1.0E14 years to eliminate all decay corrections, and the library uncertainties are all set to 5%.

6. MENU COMMANDS

6.1. Segrè Chart Screen

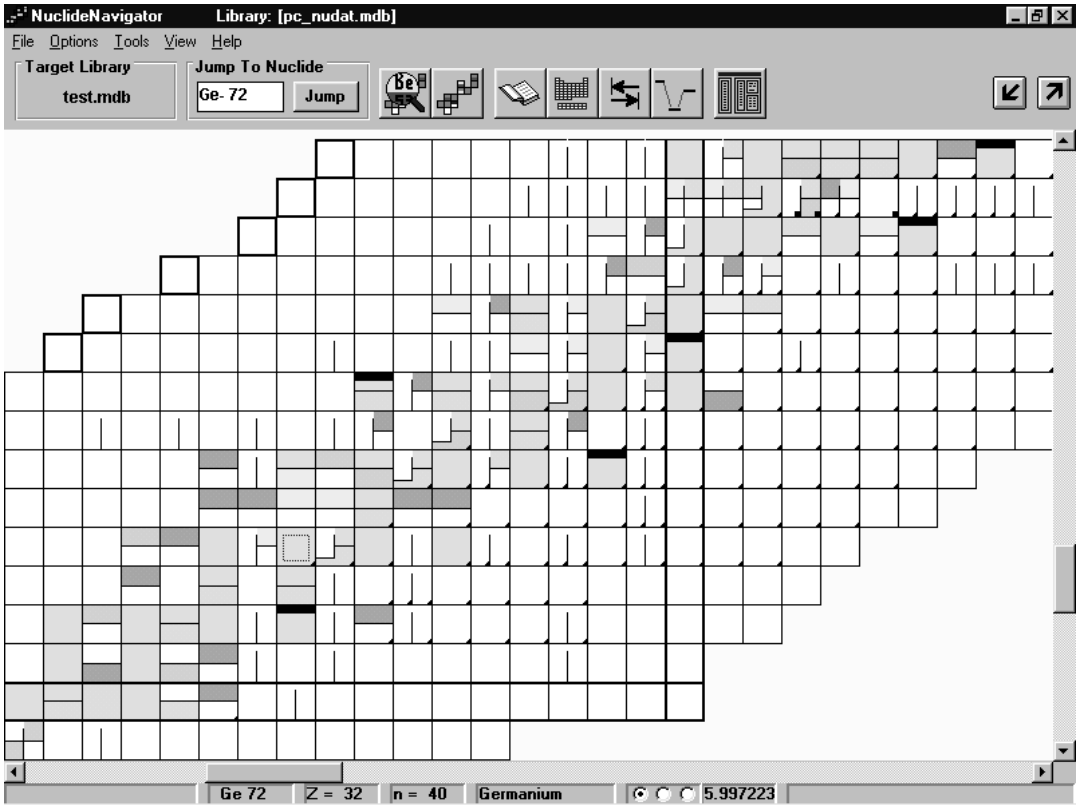

Fig. 42. Segrè Chart Condensed View.

6.1.1. File

The **File** menu is shown in Fig. 43.

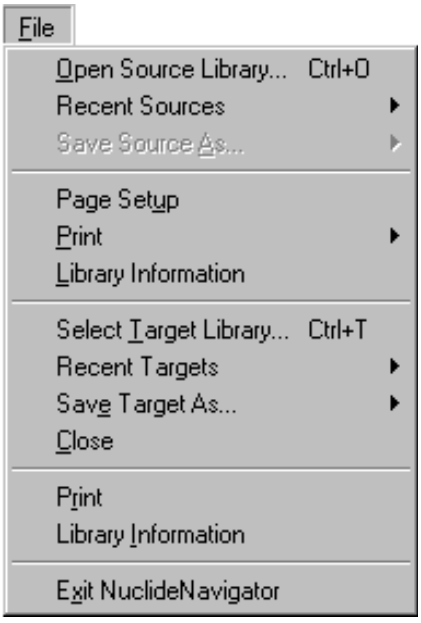

Fig. 43. Segrè Chart File Menu.

6.1.1.1. Open Source Library...

Opens a Microsoft Access or GammaVision library for viewing on the Segrè Chart. This function is duplicated by **<Ctrl+O>**.

6.1.1.2. Recent Sources ▸

Shows a list of the five most recently used source libraries. Select an entry to load that library.

6.1.1.3. Save Source As... ▸

Saves the Source Library in either Microsoft Access or GammaVision format. Not available when the Source Library is a Master Library.

6.1.1.4. Page Setup

This dialog is printer dependent. An example dialog is shown in Fig. 44 for a specific printer. It is used to set options for the printer.

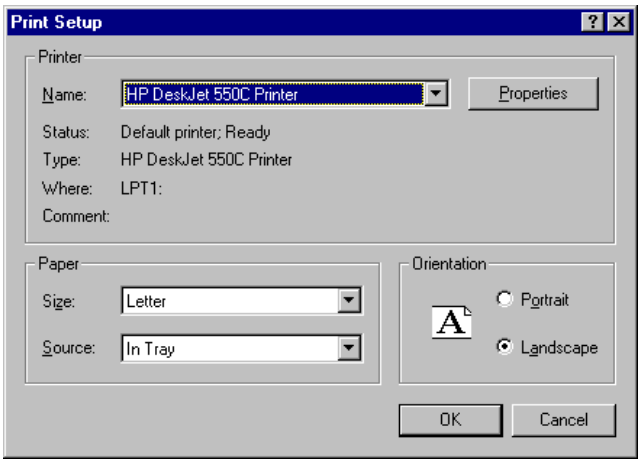

Fig. 44. Printer Options.

6.1.1.5. Print ▸

Shows the submenu (Fig. 45) to select printing in the Segrè chart or text format.

Chart Section

This prints the screen view of the Segrè chart as shown, including color on a color printer. As many complete nuclides are printed as will fit on the paper.

Library Data

Prints all of the nuclides/gamma rays located in the Source Library. The format of the printed output depends on the **Print Method** menu option. Not available when the Source Library is the Master Library. This function is duplicated by **<Ctrl+P>**.

Fig. 45. Print Submenu.

6.1.1.6. Library Information (Source)

Shows the date the library was created and last edited. It also shows the source of the information and how much is stored in the library. These fields are not in older libraries, so they cannot be displayed.

6.1.1.7. Select Target Library...

Selects a Microsoft Access or GammaVision library as the Target Library. This function is duplicated by **<Ctrl+T>**.

6.1.1.8. Recent Targets ▸

Shows a list of the five most recently used target libraries. Select an entry to load that library.

6.1.1.9. Save Target As... ▸

Saves the Target Library in either Microsoft Access or GammaVision format.

6.1.1.10. Close

Closes (unselects) the Target Library. If changes have been made to a GammaVision-format library, a dialog opens so you can save the changes.

6.1.1.11. Print

Prints all of the nuclides/gamma rays located in the Target Library. The format of the printed output depends on the **Print Method** menu option (see Section 6.1.2.1).

6.1.1.12. Library Information (Target)

Shows the date the library was created and last edited. It also shows the source of the information and how much is stored in the library. These fields are not in older libraries, so they cannot be displayed.

6.1.1.13. Exit NuclideNavigator

Closes the NuclideNavigator program. If changes have been made to a GammaVision-format library, a dialog opens so you can save the changes.

6.1.2. Options

The **Options** menu is shown in Fig. 46.

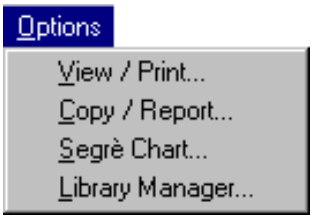

Fig. 46. Options Menu.

6.1.2.1. View/Print...

Display the dialog in Fig. 47.

Radiation

Selects **Gammas**, **Alphas**, or **Betas** to be displayed or printed whenever any operation is selected.

Print Method

Selects between listing the contents of the library with all nuclide information for all nuclides, followed by all emissions (gamma, alpha or beta) or with all emission data grouped with the nuclide data. The emissions can be listed in ascending energy order or by descending branching ratio (**Sort Printed Gammas by...**). See Figs. 26, 27, 28, and 29 as examples.

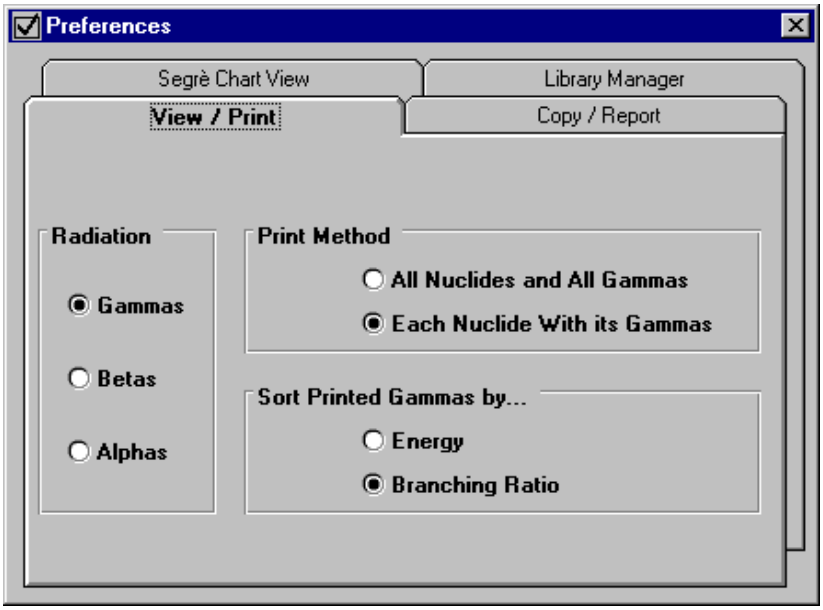

Fig. 47. View/Print.

6.1.2.2. Copy/Report... ▸

The **Copy/Report** dialog is shown in Fig. 48.

Number

Select from **All**, **Top 5**, **Top 10**, **Top 15**, or **Top 20** emissions to be listed on the report or copied to the target. The emissions with the highest branching ratio are selected. They are listed or copied in energy order. This option is used to filter out the least intense emissions from a nuclide's display, thus allowing quick identification of the top few emissions of a given nuclide. This filtering option can be turned off by simply choosing **All** as the reporting option. The total number of emissions for a nuclide will always be listed, even if reporting all of a nuclide's emissions is not a choice.

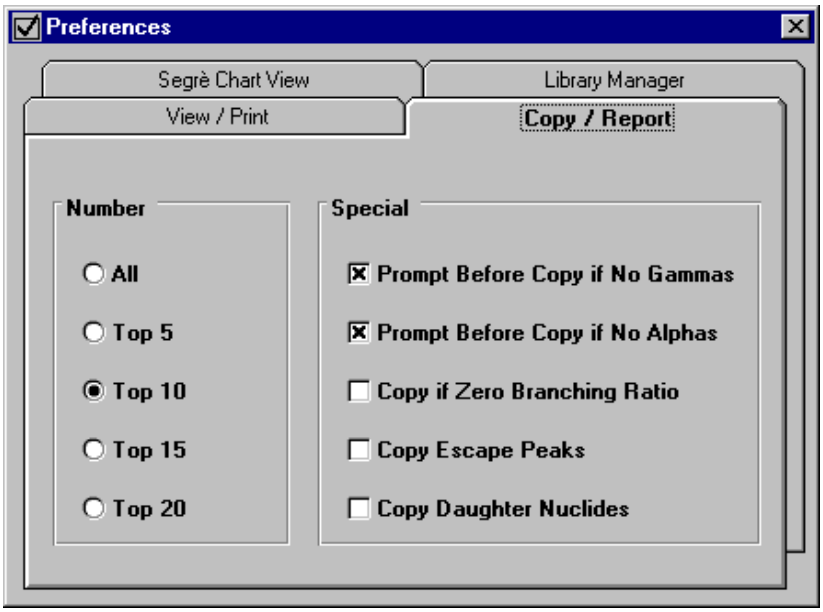

Fig. 48. Copy/Report.

Special

Prompt Before Copy if No Gammas
Marking this box will turn on the dialog to verify that a nuclide with no gamma rays is to be transferred to the Target Library. This is only asked if the **View/Print, Radiation** mode is gammas.

Prompt Before Copy if No Alphas
Marking this box will turn on the dialog to verify that a nuclide with no alpha rays is to be transferred to the Target Library. This is only asked if the **View/Print, Radiation** mode is alphas.

Copy if Zero Branching Ratio
Some entries in the master databases have zero for the branching ratio, usually because the "actual" value is not known. Unmarking this option will remove these from the copy function so that they will not be used by an analysis program.

Copy Escape Peaks
The escape peak intensity relative to other gamma rays is not constant. Thus, these lines should not be used in activity calculations. For this reason, they can be eliminated from the target copy.

Copy Daughter Nuclides
When marked, this will copy all daughters of the selected nuclide to the target. The daughters are also checked for **No Gammas** or **No Alphas**.

6.1.2.3. Library Manager...

The Thin Window Option (Fig. 49) shows only the nuclide list, while the Thick (or normal) Window shows the nuclide and emissions table.

Link Source and Target Window joins the two windows so you can more easily click and drag them around the screen.

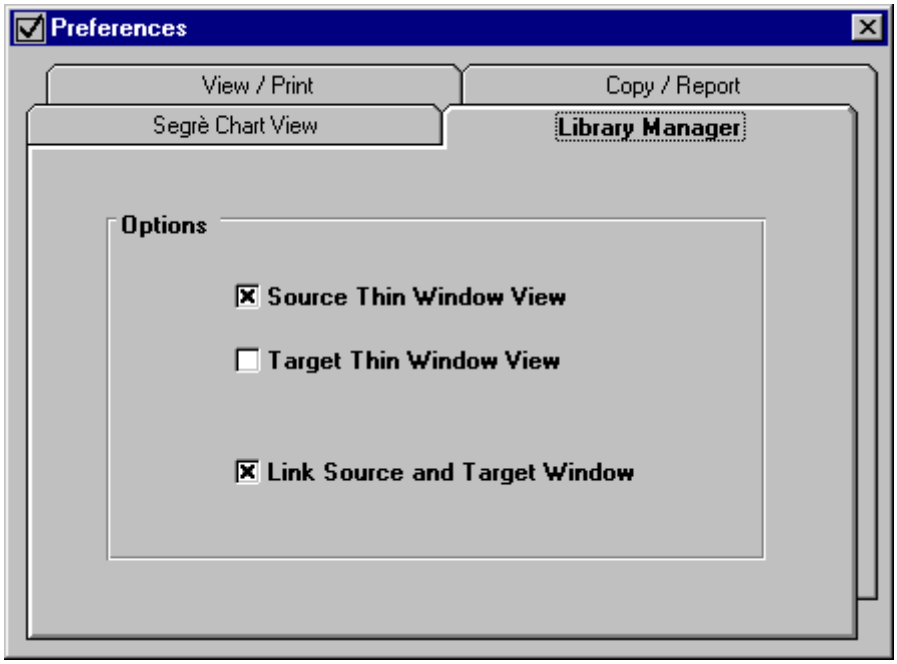

Fig. 49. Library Manager.

6.1.2.4. Segrè Chart... ▸

The Segrè Chart View dialog (Fig. 50) selects the action to be taken when a nuclide is double-clicked in the Segrè Chart View.

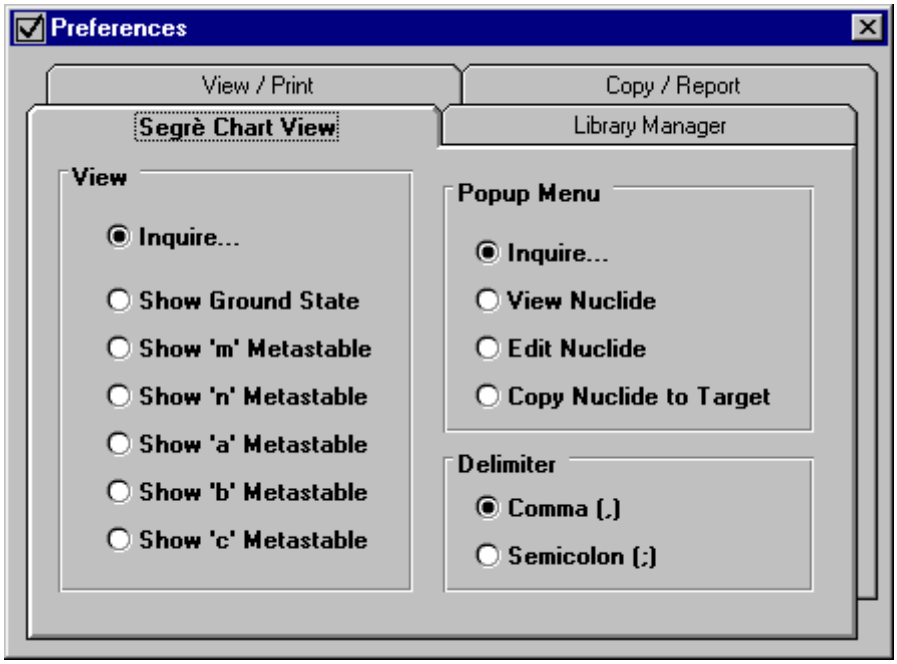

Fig. 50. Segrè Chart View.

Pop-Up Menu

Inquire...
Prompts for one of the following actions: **View Nuclide**, **Edit Nuclide**, or **Copy Nuclide to Target** whenever you double-click on a nuclide in the Segrè Chart View.

View Nuclide
Automatically displays the nuclide information, including half-life, branching ratio, and selected emissions. Additional information (such as parents, daughters, references, and associated gammas) is displayed if you are viewing the Master Library.

Edit Nuclide
Allows you to edit the nuclide's properties, such as half-life, nuclide type, and uncertainty. Several nuclide flags can also be edited. The Master Libraries cannot be edited.

Copy Nuclide to Target Library
Automatically copies the nuclide and its emissions to the selected Target Library. If no Target Library is selected, a dialog opens so you can select one.

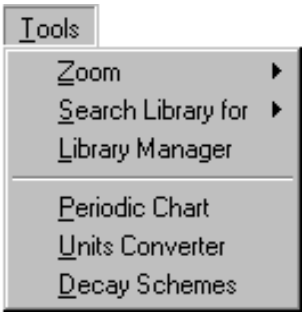

Fig. 51. Tools Menu.

6.1.3. Tools

The **Tools** menu is shown in Fig. 51.

6.1.3.1. Zoom ▸

Opens the submenu to zoom in or out on the Segrè Chart view. These are duplicated by the **Zoom In** and **Zoom Out** buttons on the tool bar, shown in Fig. 52.

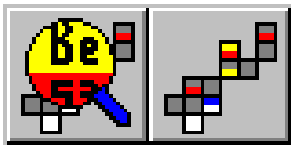
Fig. 52. Zoom Buttons.

6.1.3.2. Search Library for ▸

Opens the menu shown in Fig. 53 to select search for gammas or alphas.

Selecting **Gammas...** opens the dialog in Fig. 54.

Fig. 53. Search Library.

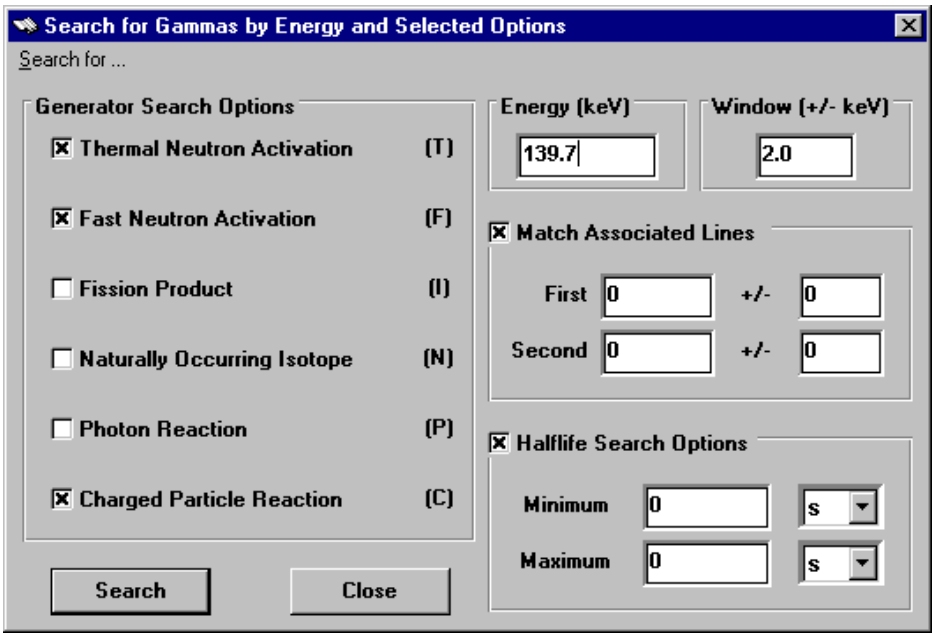

Fig. 54. Search for Gammas by Energy.

Selecting **Alphas...** opens the dialog shown in Fig. 55. Note the defaults are greater for alphas. This allows you to search in the Source Library for gamma or alpha rays in a specific energy window, as well as specify a half-life range and generator flags.

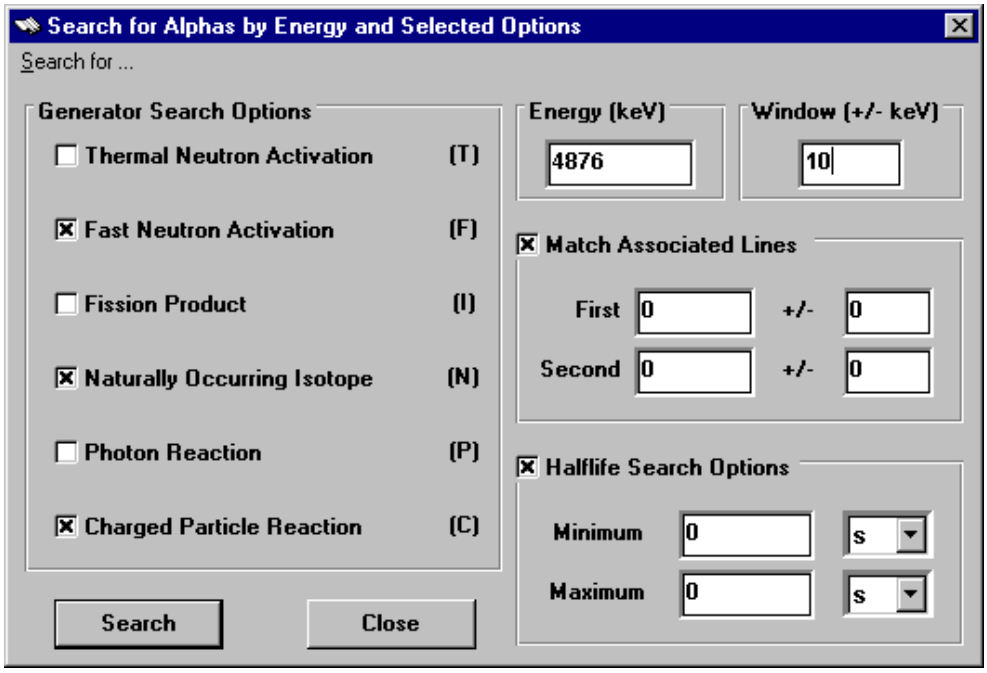

Fig. 55. Search for Alphas.

This function can also be started by clicking on the **Library Search** toolbox button (Fig. 16).

6.1.3.3. Library Manager

Switches the viewing mode from the Segrè Chart to a dual-window mode. More advanced library management functions are available in this mode, including multiple nuclide copying, adding/deleting nuclides, and adding/deleting/editing gamma rays. If the Source Library is a Master Library and there is no Target Library, a dialog opens so you can select a Target Library.

6.1.3.4. Periodic Chart

Shows the normal periodic chart (Fig. 56). To display the complete physical properties for any element (see Fig. 57), put the mouse pointer on the chemical name and either click the right mouse button or double-click the left mouse button. See Appendix A for installation options.

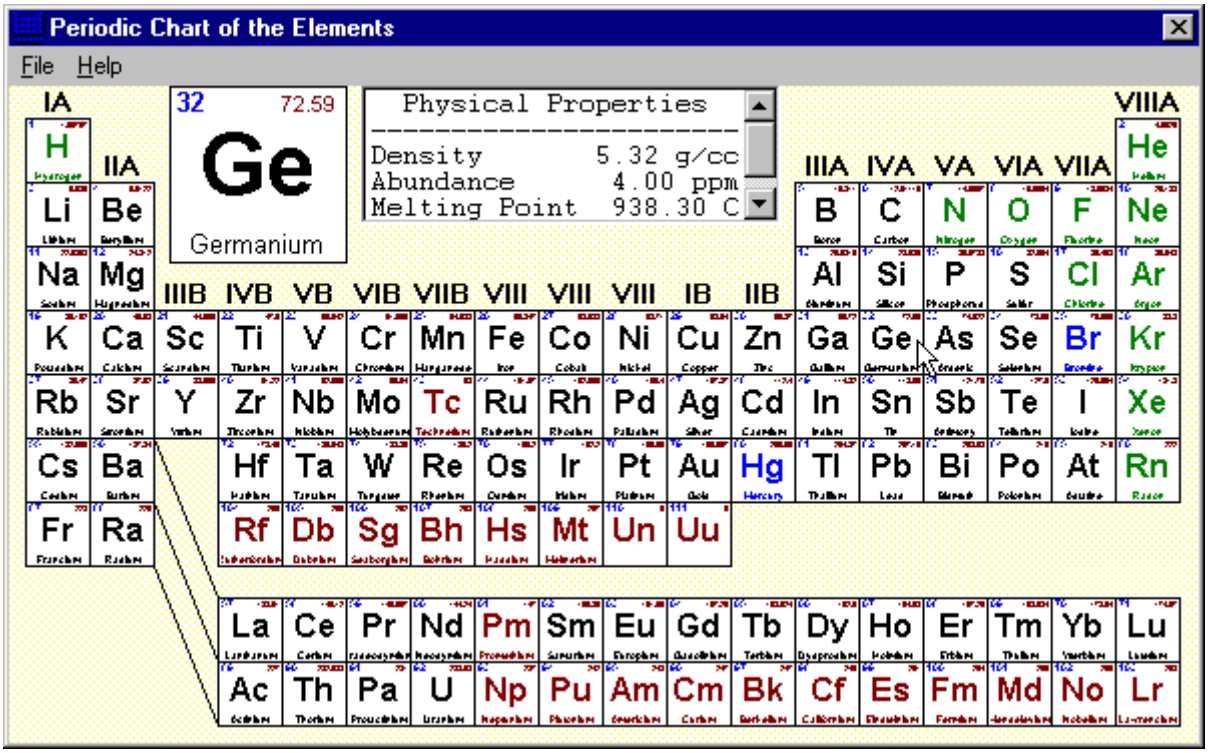
Periodic Chart of the Elements
File Help
32 72.59
Ge
Germanium
Physical Properties
Density 5.32 g/cc
Abundance 4.00 ppm
Melting Point 938.30 C
IA IIA IIIB IVB VB VIB VIIB VIII VIII VIII IB IIB IIIA IVA VA VIA VIIA VIIIA
H He
Li Be B C N O F Ne
Na Mg Al Si P S Cl Ar
K Ca Sc Ti V Cr Mn Fe Co Ni Cu Zn Ga Ge As Se Br Kr
Rb Sr Y Zr Nb Mo Tc Ru Rh Pd Ag Cd In Sn Sb Te I Xe
Cs Ba Hf Ta W Re Os Ir Pt Au Hg Tl Pb Bi Po At Rn
Fr Ra Rf Db Sg Bh Hs Mt Un Uu
La Ce Pr Nd Pm Sm Eu Gd Tb Dy Ho Er Tm Yb Lu
Ac Th Pa U Np Pu Am Cm Bk Cf Es Fm Md No Lr

Fig. 56. Complete Periodic Chart.

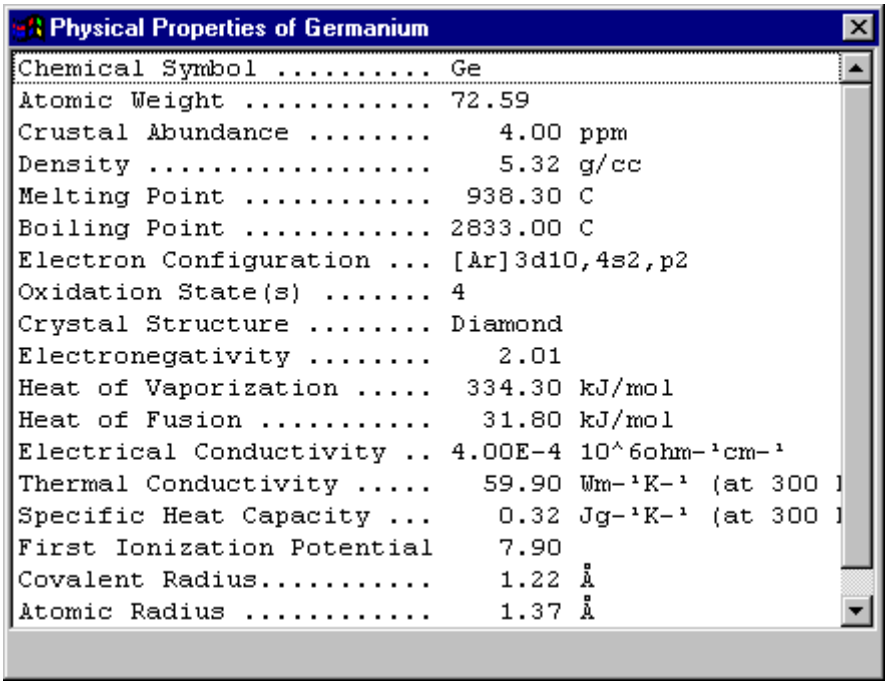
Physical Properties of Germanium
Chemical Symbol ..... Ge
Atomic Weight 72.59
Crustal Abundance ..... 4.00 ppm
Density ..... 5.32 g/cc
Melting Point ..... 938.30 C
Boiling Point ..... 2833.00 C
Electron Configuration ... [Ar]3d10,4s2,p2
Oxidation State(s) 4
Crystal Structure ..... Diamond
Electronegativity 2.01
Heat of Vaporization ..... 334.30 kJ/mol
Heat of Fusion ..... 31.80 kJ/mol
Electrical Conductivity .. 4.00E-4 10^6ohm-¹cm-¹
Thermal Conductivity ..... 59.90 Wm-¹K-¹ (at 300)
Specific Heat Capacity ... 0.32 Jg-¹K-¹ (at 300)
First Ionization Potential 7.90
Covalent Radius..... 1.22 Å
Atomic Radius ..... 1.37 Å

Fig. 57. Physical Constants.

6.1.3.5. Units Converter

The Master Converter (Fig. 58) converts from one set of units to another. For example, the conversion can be from becquerels to curies or from English measure to metric measure. Many sets of units are included so you can use this as a general utility program.

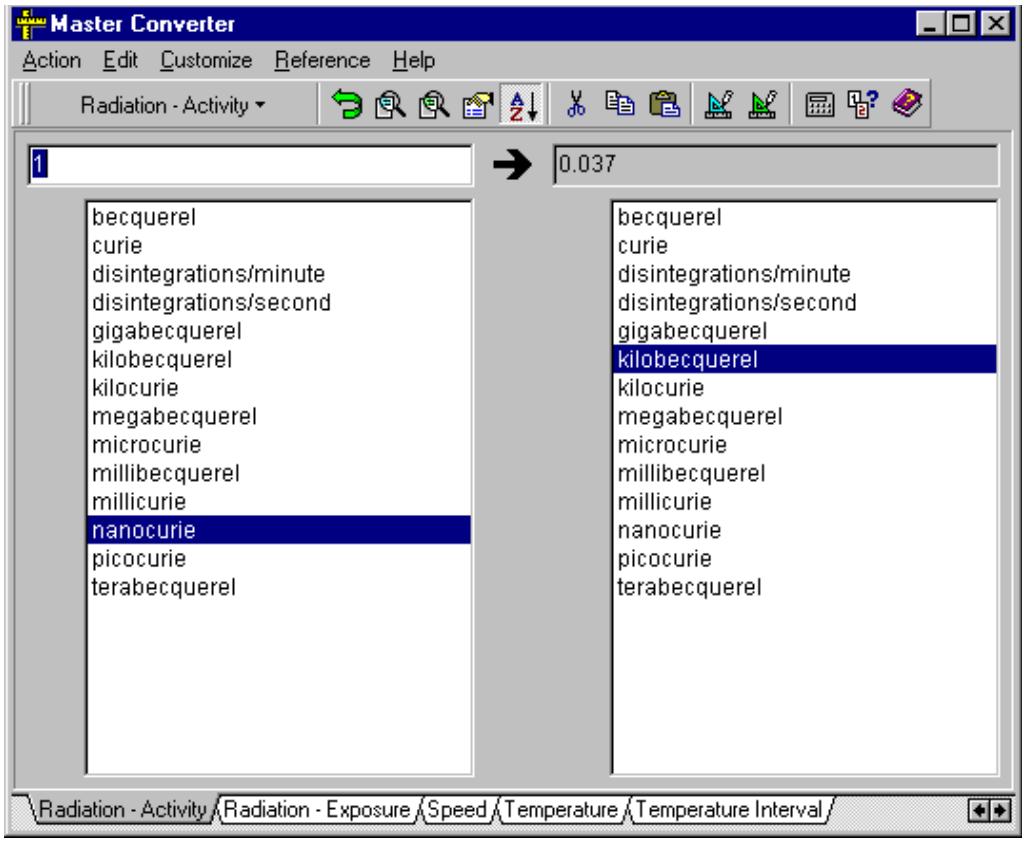

Fig. 58. Units Conversion.

Fig. 59 shows the Action menu for the Master Converter. **Invert Conversion** reverses the units displayed. For example, if the display shows the conversion

from microcuries to becquerels, **Invert Conversion** shows the conversion from becquerels to microcuries.

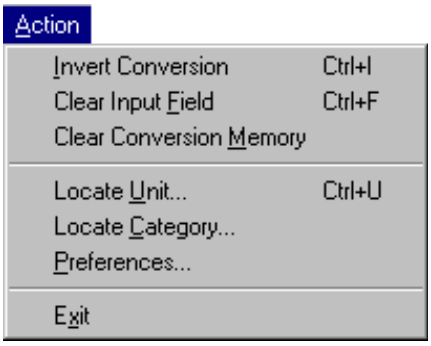

Fig. 59. Action Menu.

The **Clear Input Field** erases the numeric values entered for the conversion.

Normally, the current conversion is saved on exit and restored when the program is restarted. Select **Clear Conversion Memory** to erase this memory so the program goes to the internal selections.

Locate Unit... (Fig. 60) finds the locations on all the conversion categories for the selected unit. Complete unit names can be searched or just some of the characters. The search can be restricted to unit names which begin with the characters entered or to names with the characters located anywhere in the name. When the **Possible Matches** are displayed, select one of them and click on **Go** to go to that category.

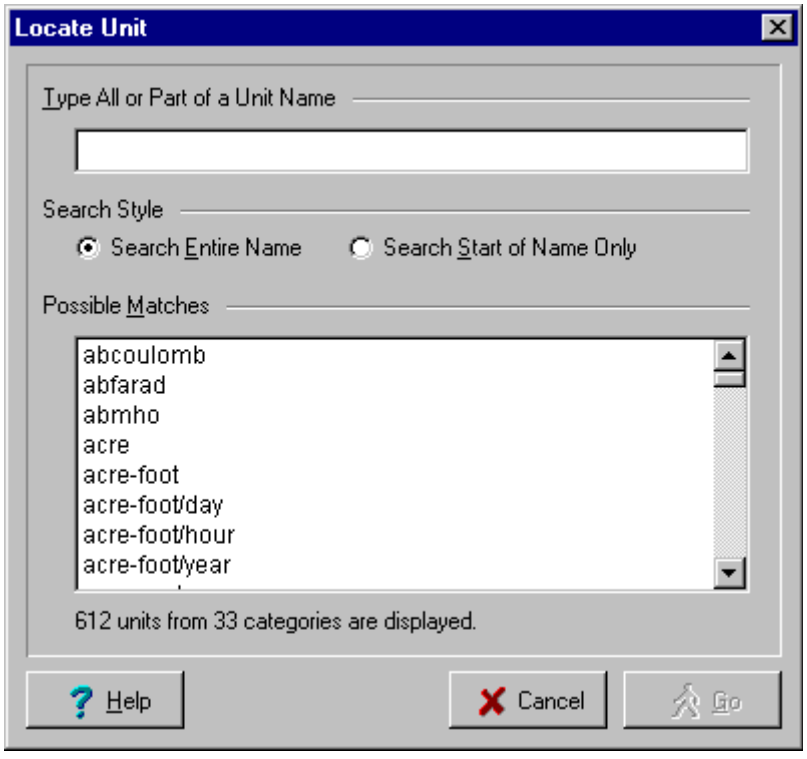

Fig. 60. Find a Type of Unit.

Locate Category... (Fig. 61) can be used to quickly find the category desired. You can search complete category names or just some of the characters. The search can be restricted to categories that begin with your search string or categories that contain the search string anywhere in the

name. When the **Possible Matches** are displayed, select one of them and press **Go** to go to that category.

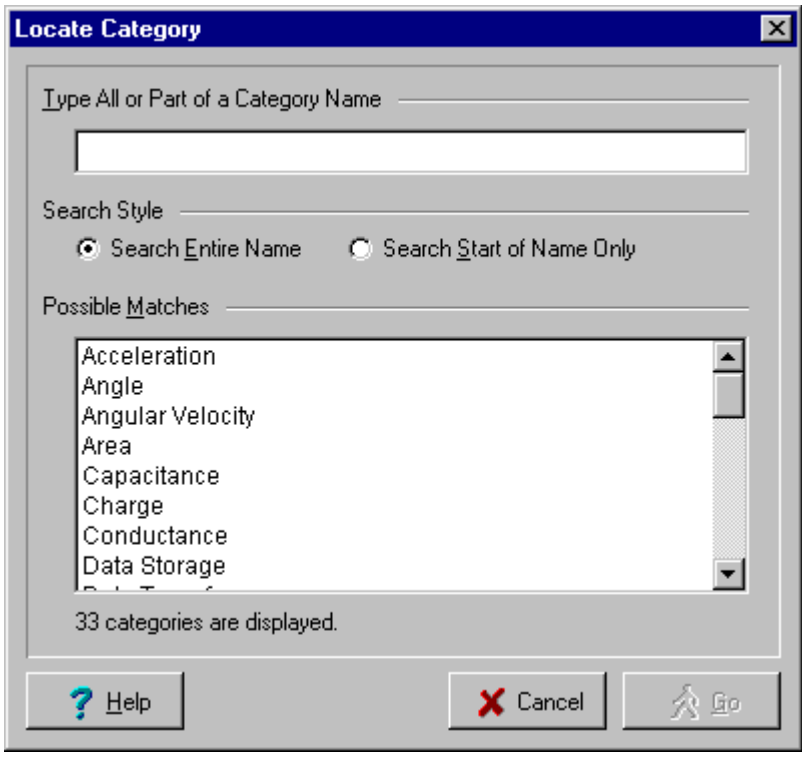

Fig. 61. Locate a Type of Category.

Preferences... (Fig. 62) sets the operating conditions for the program. Under the General tab, the toolbars can be displayed or not; the units entries sorted or not. A calculator program is also included. The **Calculator Program** can be changed to another program by selecting **Other Program** and entering the program name. Any Windows program can be used.

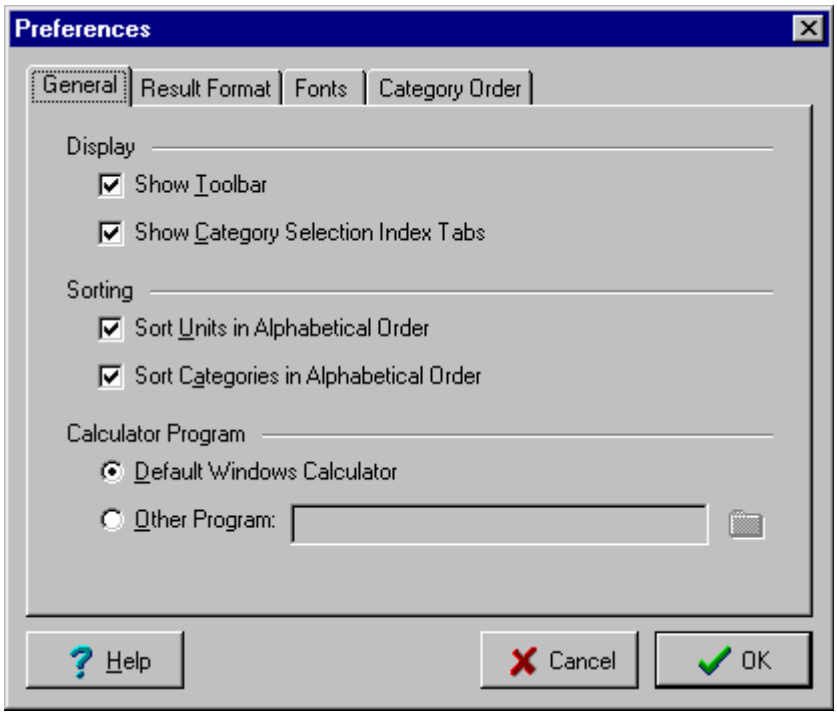

Fig. 62. Preferences.

The **Result Format** tab Fig. 63 lists the format options for the given results.

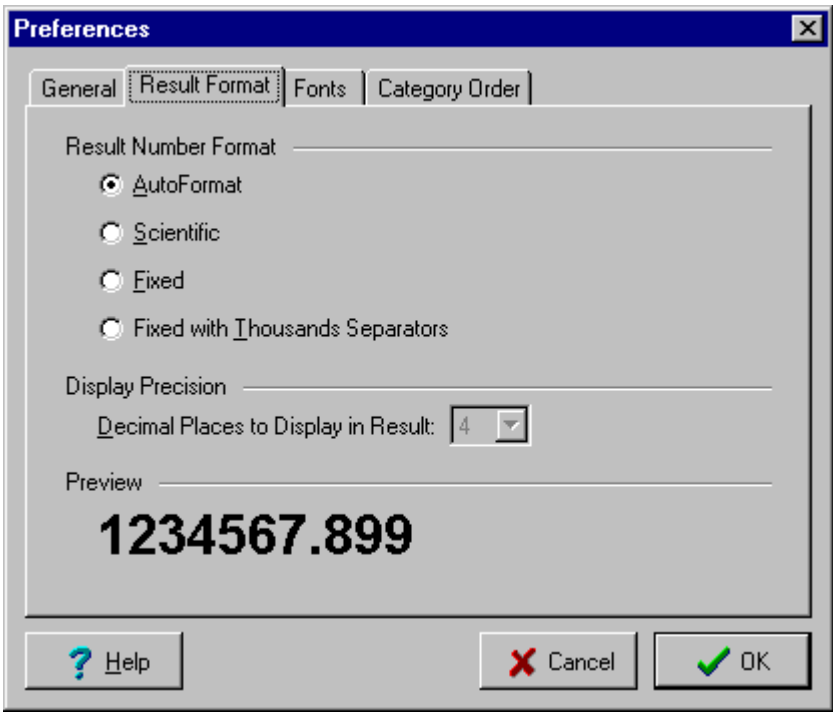

Fig. 63. Format Results Selection.

Use the **Fonts** tab (Fig. 64) to choose the fonts to be used for the parts of the dialogs.

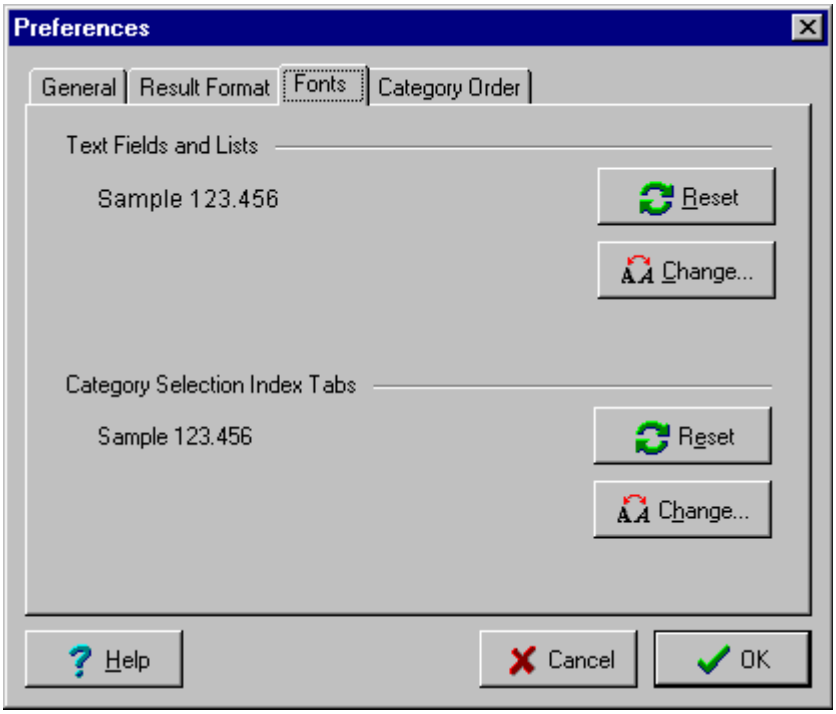

Fig. 64. Font Selection.

The **Category Order** tab (Fig. 65) shows the order in which the category tabs are listed on the Master Converter dialog (Fig. 58). Changes in this dialog are disabled if **Sort Categories by Alphabetical Order** is selected on the General folder. The categories can be moved so that the commonly used categories are adjacent to one another. This minimizes the amount of scrolling back and forth among the different categories.

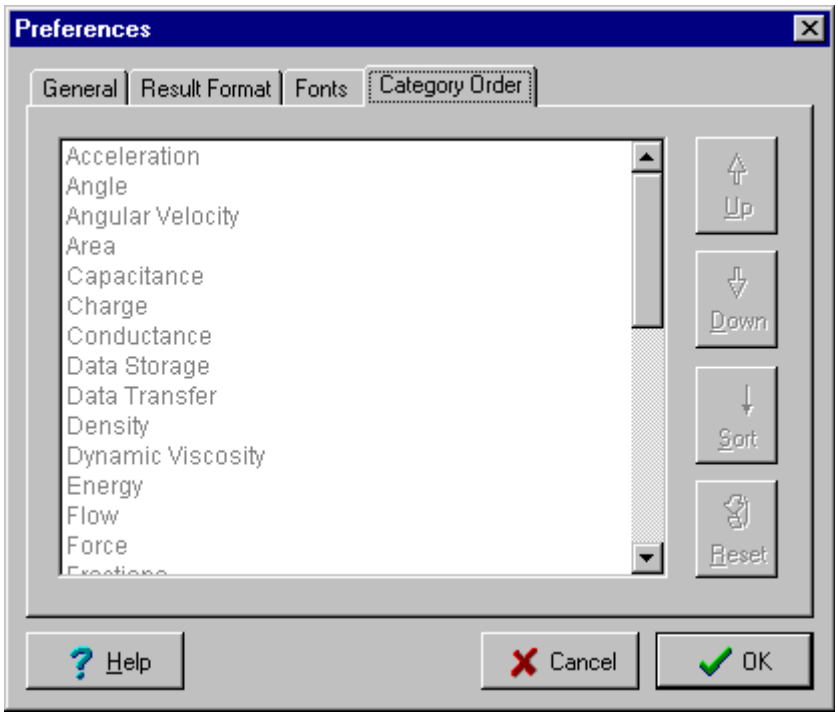

Fig. 65. Sort Categories.

The **Edit** menu (Fig. 66) contains the common Windows edit commands you can use for entering text in the entry fields.

The **Customize** menu (Fig. 67) allows you to add units and categories to the current extensive list. The new conversions become available on the tabs and dialogs in the same manner as the internal units and categories.

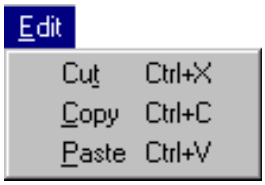

Fig. 66. Units Edit Menu.

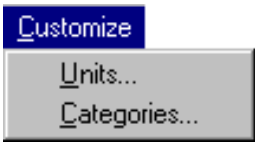

Fig. 67. Units Customize Menu.

Select **Units...** to add a new unit to one of the categories as shown in Fig. 68.

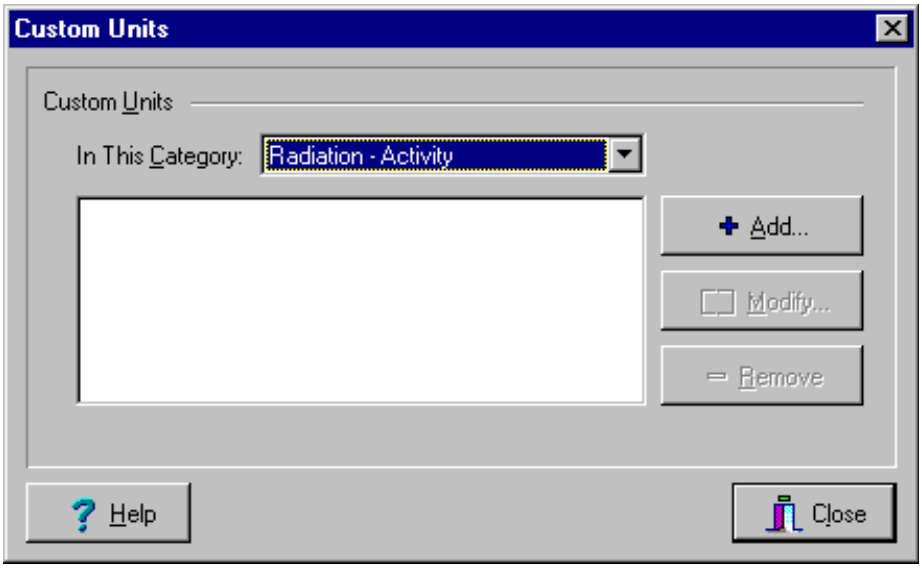

Fig. 68. Adding a New Unit.

6.1.3.6. Decay Schemes

This command allows you to display the nuclide decay schemes using the Adobe Acrobat Reader supplied with NuclideNavigator III. All of the available 277 schemes can be viewed. This command is duplicated by the **Decay Scheme** toolbar button (Fig. 69).

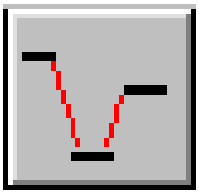

Fig. 69. Decay Scheme Button.

Figure 70 shows an example of the decay schemes. To select the atomic number to be displayed, use the right-hand slider. The display will show the page number which is the atomic number.

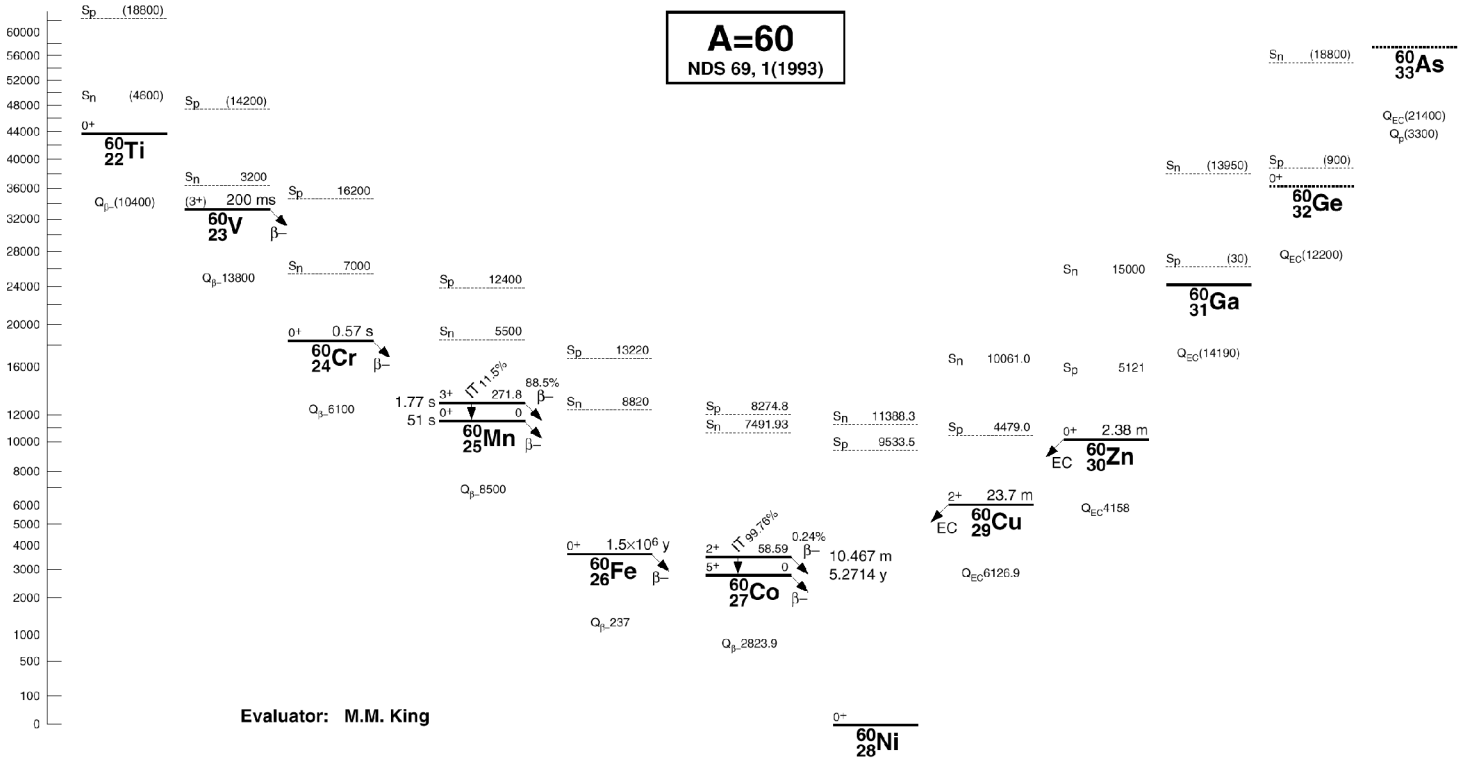

Fig. 70. Example Decay Scheme.

6.1.4. View

This menu (Fig. 71) gives you the option of selecting the whole library to view in the Segrè Chart view or any one of the natural decay series. If one of the decay series is selected (Fig. 72), the display shows only the elements in the series, properly positioned on the chart with the decay modes shown between the parent and daughter nuclides.

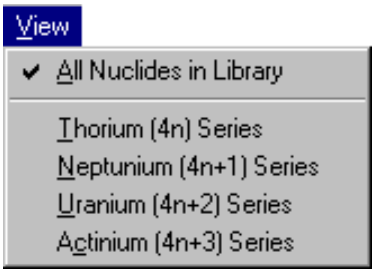

Fig. 71. Segrè Chart View.

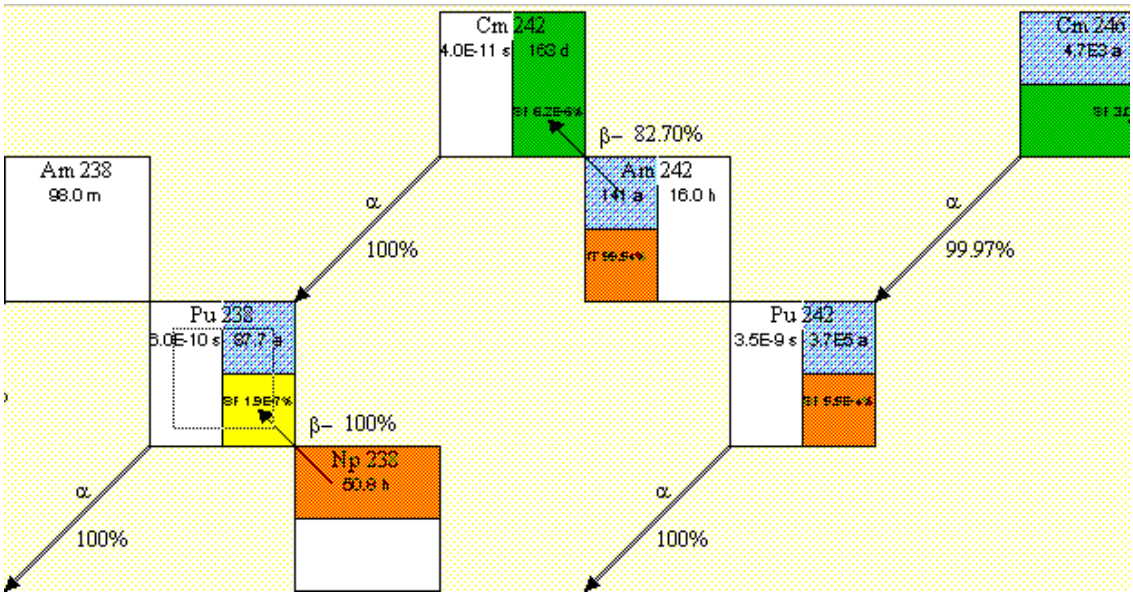

Fig. 72. Natural Series Display.

6.1.5. Help

6.1.5.1. Contents

This displays the contents of the online help file.

6.1.5.2. Search for Help On

This displays a dialog for searching the help database for information on a specific subject.

6.1.5.3. Legend

Opens a legend explaining the symbols that appear on the Segrè Chart as shown in Figs. 3 through 11.

6.1.5.4. About

The About screen (Fig. 73) provides version information that may be useful should you need customer support.

Fig. 73. About Screen.

6.2. Library Manager View

6.2.1. File (Source Window)

The Library Manager **File** menu is shown in Fig. 74.

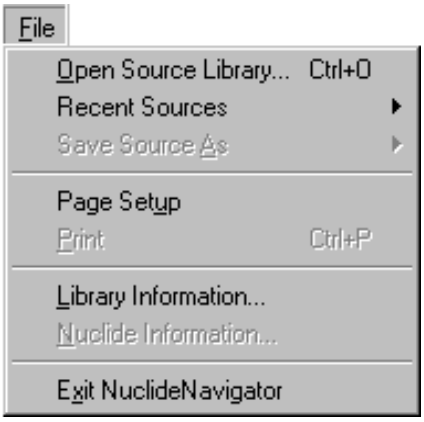

Fig. 74. Library Manager File Menu (Source Window).

6.2.1.1. Open Source Library...

Opens a Microsoft Access or GammaVision library for editing. This function is duplicated by **<Ctrl+O>**.

6.2.1.2. Recent Sources ▸

Shows a list of the five most recently used source libraries. Select an entry to load that library.

6.2.1.3. Save Source As ▸

Saves the library in either Microsoft Access or GammaVision format. Not available for a Master Library.

6.2.1.4. Page Setup

This dialog is printer dependent. An example dialog is shown in Fig. 44 for a specific printer. It is used to set options for the printer.

6.2.1.5. Print

Prints all of the nuclides/emissions in the library. The format of the printed output depends on the selections in **Options/View/Print** (see Section 6.1.2.1). This function is duplicated by **<Ctrl+P>**.

6.2.1.6. Library Information...

Displays information on the library. Includes the creation date, last edit date, and the number of nuclides, gamma rays, alpha rays, and beta rays in the library.

6.2.1.7. Nuclide Information...

Displays information on the currently selected nuclide. Same as view shown in Fig. 14, page 10.

6.2.1.8. Exit NuclideNavigator

Closes the NuclideNavigator program. If changes have been made to a GammaVision format library, a dialog opens so you can save the changes.

6.2.2. Edit (Source Window)

The following are not available for Master Library. The Edit menu is shown in Fig. 75 and duplicates the Edit functions for the Target Library.

Fig. 75. Library Manager Edit Menu (Source Window).

6.2.2.1. Add Nuclide...

Adds a nuclide to the library. This is duplicated by **<Ctrl+Ins>**.

6.2.2.2. Edit Nuclide...

Edits a nuclide in the library.

6.2.2.3. Delete Nuclide

Removes the currently selected nuclide and its gamma rays from the library.

6.2.2.4. Add Gamma Ray...

Adds a gamma ray to the currently selected nuclide. This is duplicated by **<Shift+Ins>**.

6.2.2.5. Edit Gamma Ray...

Edits the selected gamma ray.

6.2.2.6. Delete Gamma Rays

Deletes the selected gamma rays. A dialog opens to verify each gamma ray deletion. this is duplicated by **<Shift+Del>**.

6.2.2.7. ReSort Gammas by ▸

This resorts the list of gamma rays by energy or branching ratio. This duplicates the buttons above the displayed list.

NOTE If alpha rays are selected, the instructions in Sections 6.2.2.4 through 6.2.2.7 hold for alpha rays instead of gamma rays.

6.2.3. Options (Source Window)

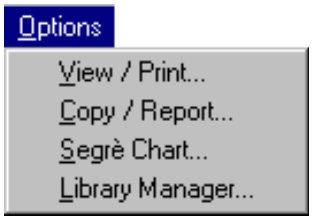

Fig. 76. Library Manager Options Menu (Source Window).

The **Options** menu is shown in Fig. 76.

6.2.3.1. View/Print...

Displays the dialog in Fig. 77.

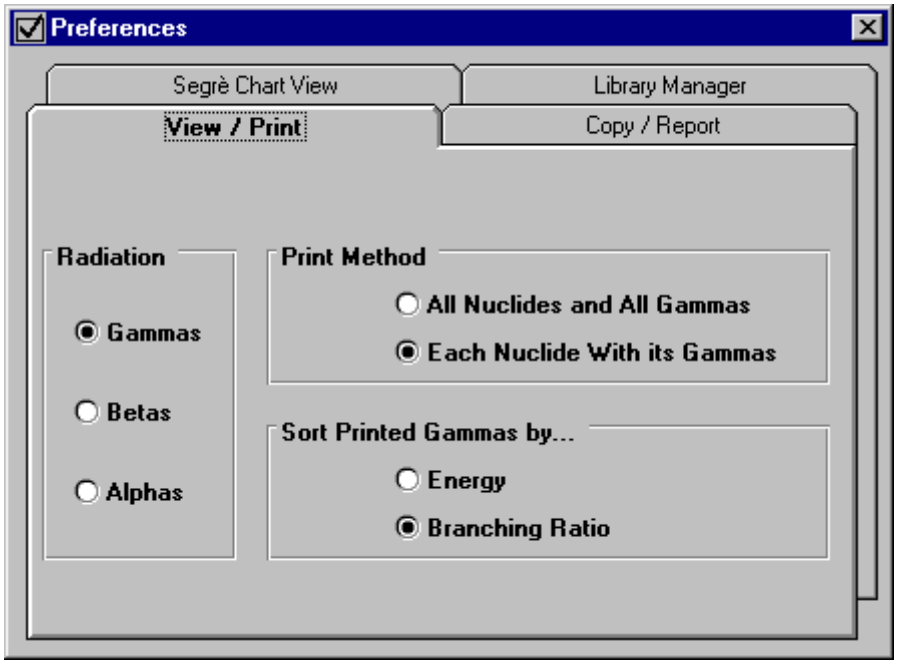

Fig. 77. View/Print.

Radiation
Selects **Gammas**, **Alphas**, or **Betas** to be displayed or printed whenever any operation is selected.

Print Method
Selects between listing the contents of the library with all the nuclide information for all nuclides, followed by all emissions (gamma, alpha, or beta) or with all emission data grouped with the nuclide data. The emissions can be listed in ascending energy order or by descending branching ratio order. See Figs. 26, 27, 28, and 29 as examples.

6.2.3.2. Copy/Report... ▸

The **Copy/Report** dialog is shown in Fig. 78.

Number
Select from **All**, **Top 5**, **Top 10**, **Top 15**, or **Top 20** emissions to be listed on the report or copied to the target. The emissions with the highest branching ratio are selected. They are listed or copied in energy order. This option is used to filter out the least intense emissions from a nuclide's display, allowing quick identification of the top few emissions of a given nuclide. To turn off this filtering option, choose **All** as the reporting option. The total number of emissions for a nuclide will always be listed, even if reporting all of a nuclide's emissions is not a choice.

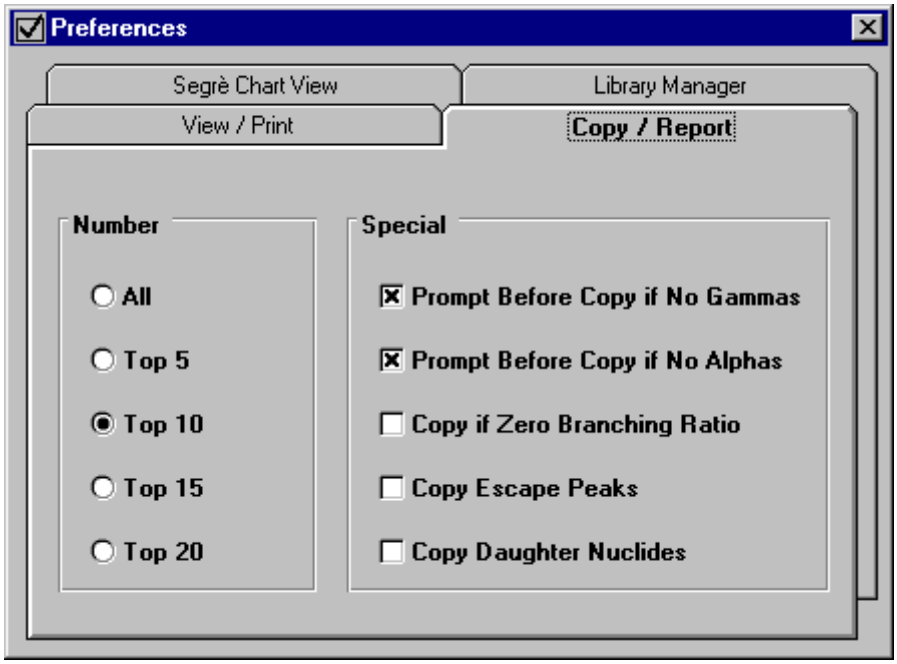

Fig. 78. Copy/Report Menu.

Special

Prompt Before Copy if No Gammas

Marking this box turns on the dialog to verify that a nuclide with no gamma rays is to be transferred to the Target Library. This is only asked if the **View/Print, Radiation** mode is gammas.

Prompt Before Copy if No Alphas

Marking this option turns on or off the dialog to verify that a nuclide with no alpha rays is to be transferred to the Target Library. This is only asked if the **View/Print, Radiation** mode is alphas.

Copy if Zero Branching Ratio

Some entries in the master databases have zero for the branching ratio, usually because the "actual" valve is not known. Unmarking this option removes these from the copy function so they will not be used by an analysis program.

Copy Escape Peaks

The escape peak intensity relative to other gamma rays for the same nuclide is not constant. Thus, these lines should not be used in activity calculations. For this reason, they can be eliminated from the target copy.

Copy Daughter Nuclides

Marking this box copies all daughters of the selected nuclide to the target. The daughters are also checked for **No Gammas** or **No Alphas**.

6.2.3.3. Library Manager...

The Thin Window Option (Fig. 79) shows only the nuclide list, while the Thick Window shows the nuclide and emissions table.

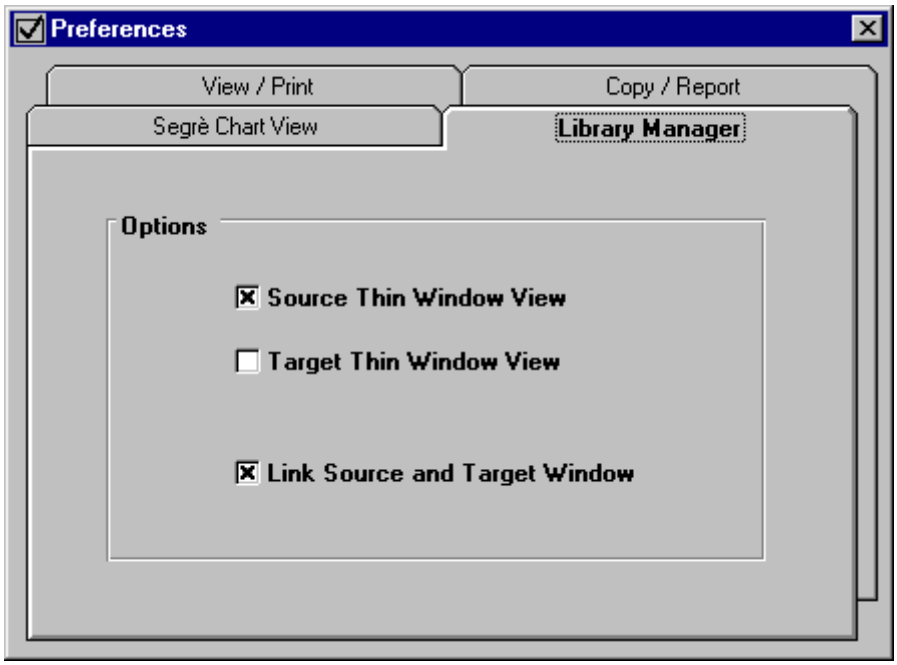

Fig. 79. Library Manager View.

The Source and Target Dialogs can be linked together so you can more easily move them around the screen.

6.2.3.4. Segrè Chart... ▸

The Segrè Chart View dialog (Fig. 80) selects the action to be taken when you double-click a nuclide in the Segrè Chart View.

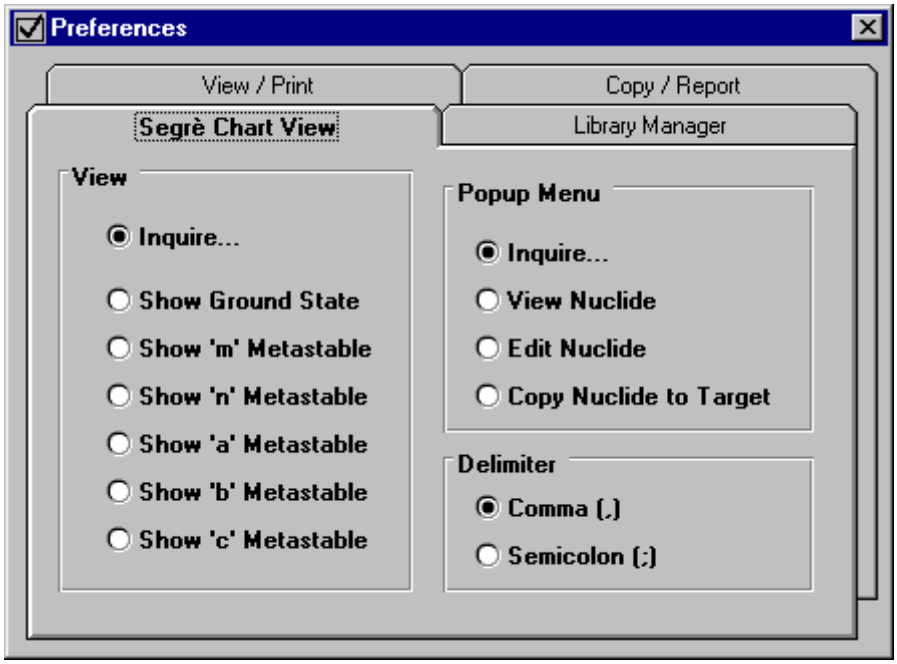

Fig. 80. Segrè Chart View.

Pop-Up Menu

Inquire...

This prompts for one of the following actions: **View Nuclide**, **Edit Nuclide**, or **Copy Nuclide to Target** whenever you double-click on a nuclide in the Segrè Chart View.

View Nuclide

This automatically displays the nuclide information, including half-life, branching ratio, and selected emissions. Additional information (such as parents, daughters, references, and associated gammas) is displayed when viewing the Master Library.

Edit Nuclide

This allows you to edit the nuclides properties, such as half-life, nuclide type, and uncertainty. Several nuclide flags can also be edited. The Master Libraries cannot be edited.

Copy Nuclide to Target Library

Automatically copies the nuclide and its emissions to the selected Target Library. If no Target Library is selected, a dialog opens so you can select one.

6.2.4. Tools (Source Window)

The Tools menu is shown in Fig. 81.

6.2.4.1. Search Library for ▸

Opens the menu shown in Fig. 82 so you can choose to search for gammas or alphas.

Fig. 81. Tools Menu.

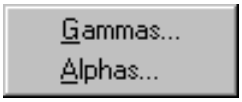

Fig. 82. Search Library.

Selecting **Gammas...** opens the dialog in Fig. 83.

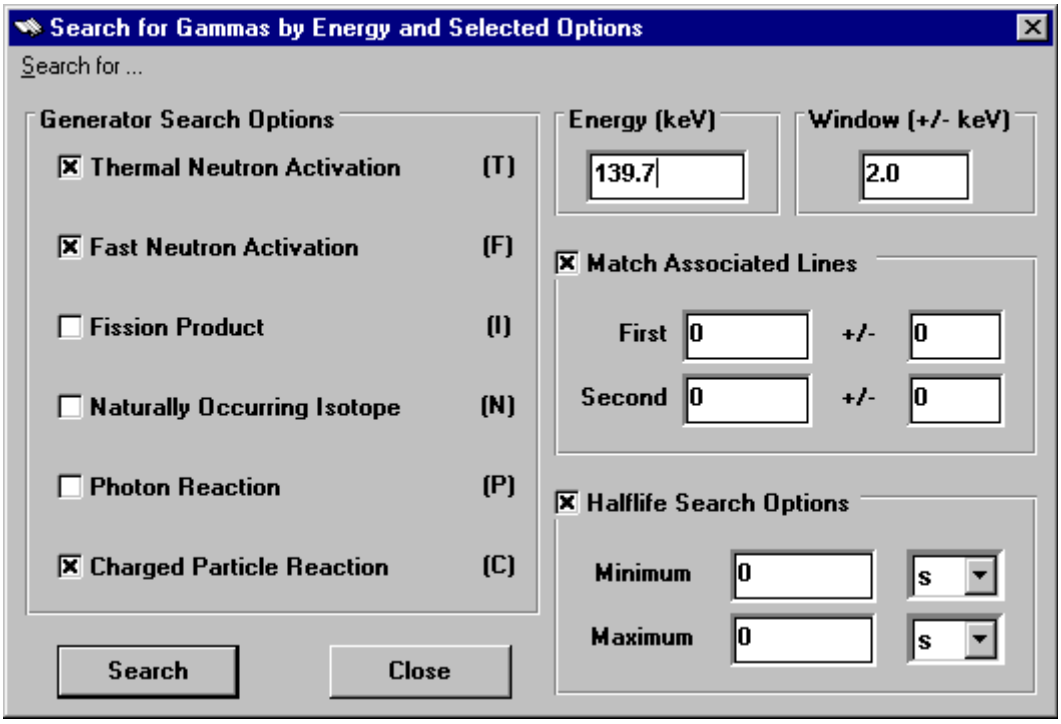

Fig. 83. Search for Gammas by Energy.

Selecting **Alphas...** opens the dialog shown in Fig. 84. Note the defaults are greater for alphas. This allows you to search in the Source Library for gamma or alpha rays in a specific energy window. You can also specify a half-life range and generator flags.

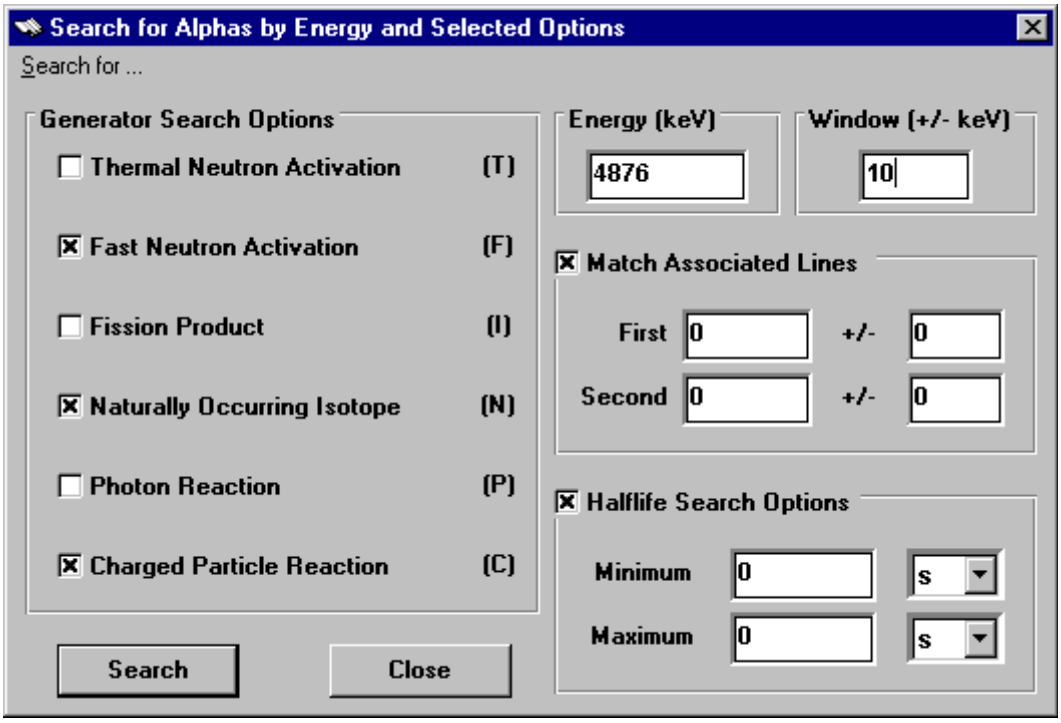

Fig. 84. Search for Alphas.

6.2.4.2. Library Manager

Switches the viewing mode from the Segrè Chart to a dual-windowed mode. More advanced library management functions are available in this mode, including multiple nuclide copying, adding/deleting nuclides, and adding/deleting/editing gamma rays. If the Source Library is a master library and there is no Target Library, a dialog is displayed to select a Target Library.

6.2.4.3. Periodic Chart

Shows the normal periodic chart (Fig. 85). To display the complete physical properties for any element (see Fig. 86) put the mouse pointer on the chemical name and either click the right mouse button or double-click the left mouse button. See Appendix A for installation options.

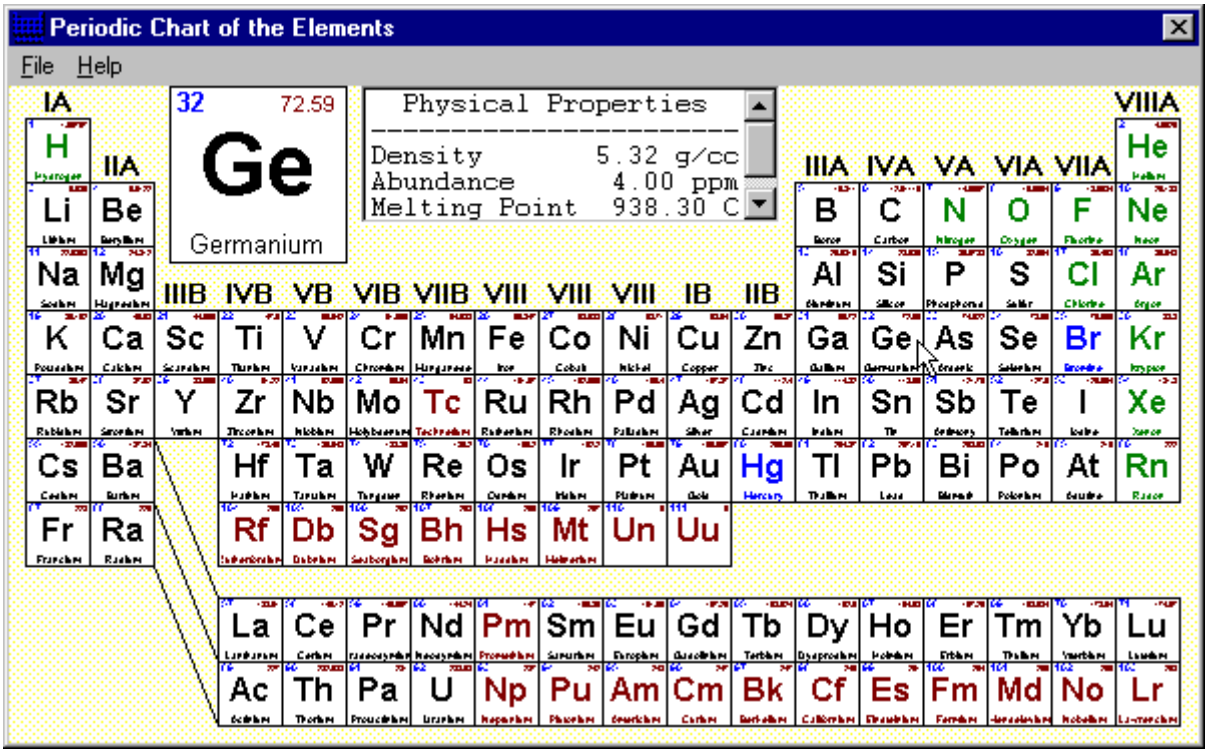
Periodic Chart of the Elements
File Help
32 72.59
Ge
Germanium
Physical Properties
Density 5.32 g/cc
Abundance 4.00 ppm
Melting Point 938.30 C
IA IIA IIIB IVB VB VIB VIIB VIII VIII VIII IB IIB IIIA IVA VA VIA VIIA VIIIA
H He
Li Be B C N O F Ne
Na Mg Al Si P S Cl Ar
K Ca Sc Ti V Cr Mn Fe Co Ni Cu Zn Ga Ge As Se Br Kr
Rb Sr Y Zr Nb Mo Tc Ru Rh Pd Ag Cd In Sn Sb Te I Xe
Cs Ba Hf Ta W Re Os Ir Pt Au Hg Tl Pb Bi Po At Rn
Fr Ra Rf Db Sg Bh Hs Mt Un Uu
La Ce Pr Nd Pm Sm Eu Gd Tb Dy Ho Er Tm Yb Lu
Ac Th Pa U Np Pu Am Cm Bk Cf Es Fm Md No Lr

Fig. 85. Complete Periodic Chart.

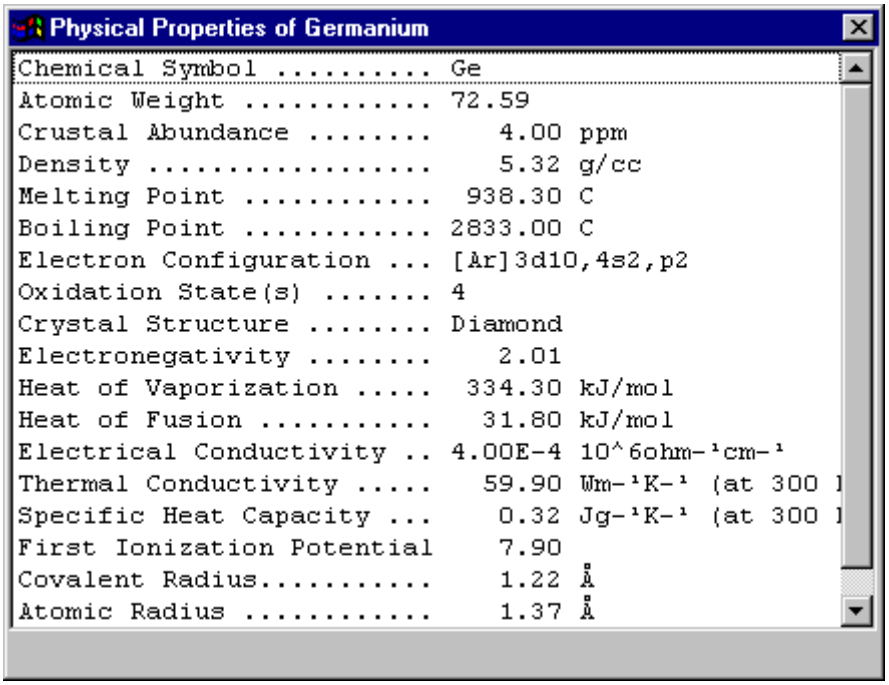
Physical Properties of Germanium
Chemical Symbol ..... Ge
Atomic Weight 72.59
Crustal Abundance ..... 4.00 ppm
Density ..... 5.32 g/cc
Melting Point ..... 938.30 C
Boiling Point ..... 2833.00 C
Electron Configuration ... [Ar]3d10,4s2,p2
Oxidation State(s) 4
Crystal Structure ..... Diamond
Electronegativity 2.01
Heat of Vaporization ..... 334.30 kJ/mol
Heat of Fusion ..... 31.80 kJ/mol
Electrical Conductivity .. 4.00E-4 10^6ohm-¹cm-¹
Thermal Conductivity ..... 59.90 Wm-¹K-¹ (at 300 K)
Specific Heat Capacity ... 0.32 Jg-¹K-¹ (at 300 K)
First Ionization Potential 7.90
Covalent Radius..... 1.22 Å
Atomic Radius ..... 1.37 Å

Fig. 86. Physical Constants.

6.2.4.4. Units Converter

Use the Master Converter (Fig. 87) to convert from one set of units to another. For example, the conversion can be from becquerels to curies or from English measure to metric measure. Many sets of units are included so you can use this as a general utility program. For complete details, see Section 6.1.3.5.

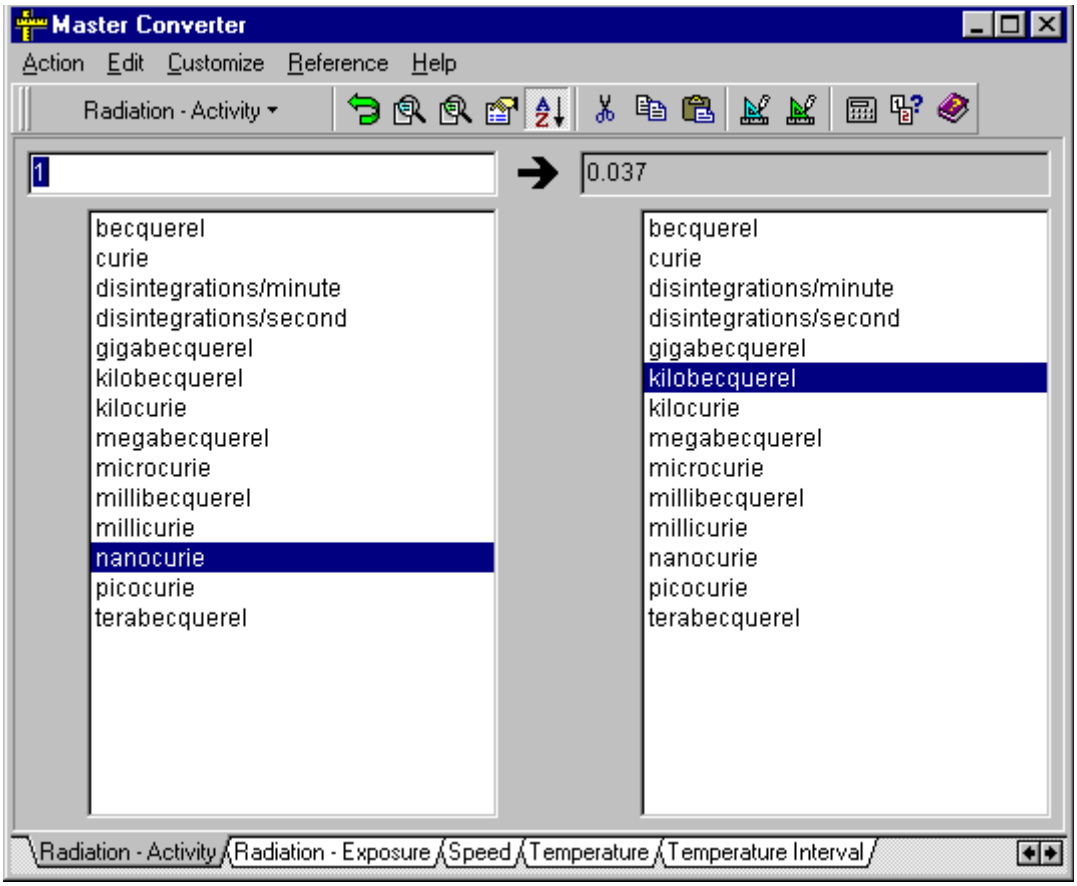

Fig. 87. Units Conversion.

6.2.4.5. Decay Schemes

This command allows you to display the nuclide decay schemes using the Adobe Acrobat Reader supplied with NuclideNavigator III. All of the available 277 schemes can be viewed. This command is duplicated by the **Decay Scheme** toolbar button (Fig. 88).

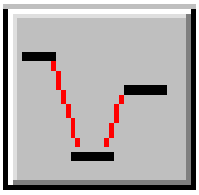

Fig. 88. Decay Scheme Button.

Figure 89 shows an example of the decay schemes. To select the atomic number to be displayed, use the right-hand slider. The display will show the page number which is the atomic number.

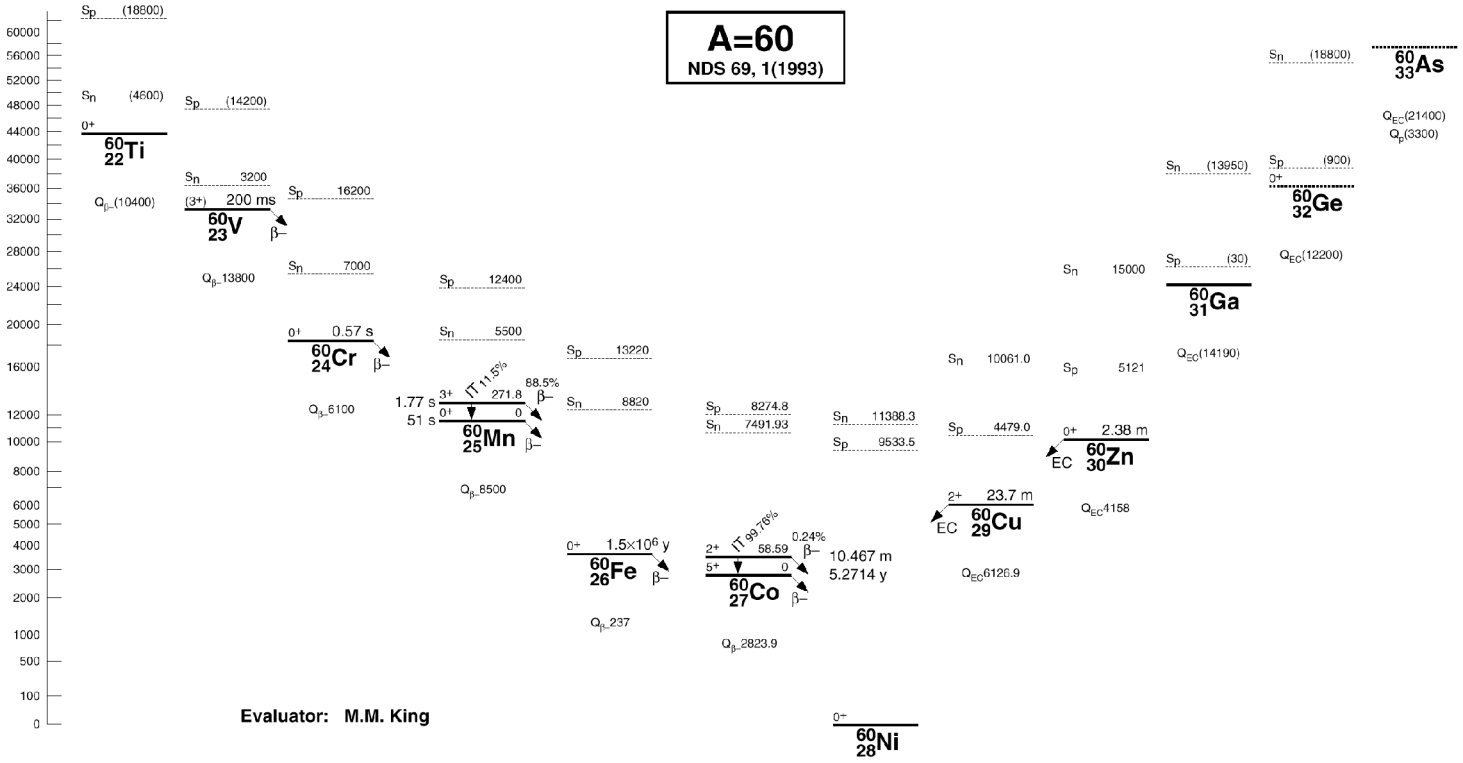

Fig. 89. Example Decay Scheme.

6.2.5. Help

6.2.5.1. Contents

This displays the contents of the online help file.

6.2.5.2. Search for Help On

This displays a dialog for searching the help database for information on a specific subject.

6.2.5.3. About

This displays the About screen as shown in Fig. 73.

6.2.6. File (Target Window)

The Target **File** menu is shown in Fig. 90. The Master Library cannot be the Target Library.

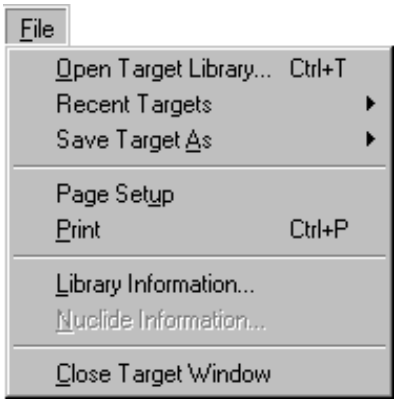

Fig. 90. Library Manager File Menu (Target Window).

6.2.6.1. Open Target Library...

Opens a Microsoft Access or GammaVision library for editing. This function is duplicated by **<Ctrl+O>**.

6.2.6.2. Recent Targets ▸

Shows a list of the five most recently used target libraries. Select an entry to load that library.

6.2.6.3. Save Target As ▸

Saves the library in either Microsoft Access or GammaVision format.

6.2.6.4. Page Setup

This dialog is printer dependent. An example dialog is shown in Fig. 91 for a specific printer. It is used to set options for the printer.

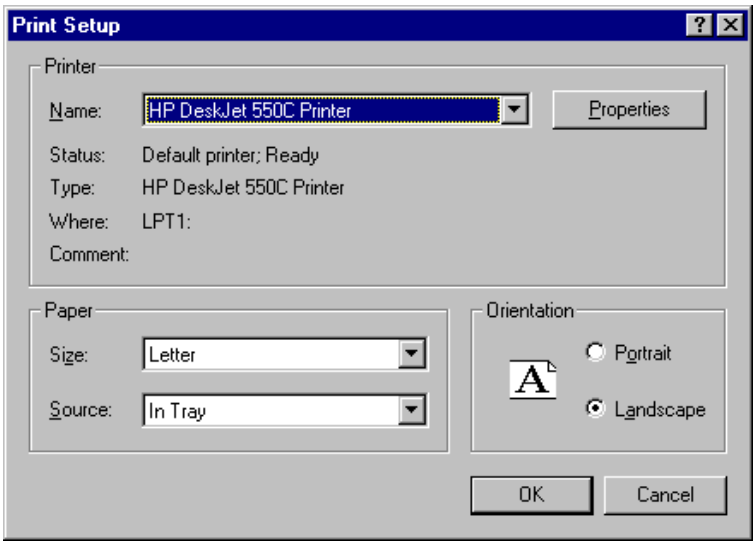

Fig. 91. Printer Options.

6.2.6.5. Print

Prints all of the nuclides/gamma rays located in the library. The format of the printed output depends on the **Options/ View/Print** menu option. This function is duplicated by **<Ctrl+P>**.

6.2.6.6. Library Information...

Displays information on the library, including the creation date, last edit date, and the number of nuclides, gamma rays, alpha rays, and beta rays in the library.

6.2.6.7. Nuclide Information...

Displays information on the currently selected nuclide as shown in Fig. 14, page 10.

6.2.6.8. Close Target Window

This closes the Target Library and target window, but does not exit NuclideNavigator.

6.2.7. Edit (Target Window)

The **Edit** menu is shown in Fig. 92.

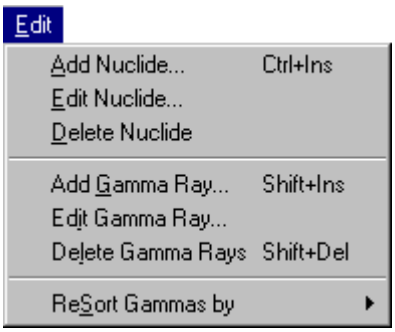

Fig. 92. Library Manager Edit Menu (Target Window).

6.2.7.1. Add Nuclide...

This command opens a dialog (Fig. 93) that lets you add a nuclide to the library. This function is duplicated by **<Ctrl+Ins>**. The nuclide to be added must be a valid chemical symbol, the atomic

weight must be greater than 1, and the metastable states are designated by M, N, A, B, or C. If the atomic weight is an unexpected value, a dialog will ask for verification before the nuclide is accepted.

After the nuclide has been properly entered and accepted, the nuclide properties dialog (Fig. 94) opens. The **Half-life** can be any positive, non-zero number; select the units from the drop-down list. The **Nuclide Type** is a number from 0 to 3200. The **Uncertainty** represents the composite uncertainty in the values entered for this nuclide. It is the 2 σ (95%) value. All of these entries, including the nuclide **Flags**, are saved in the library to be used by other programs. The **Parents** and **Daughters** fields *must have valid isotope names*. The field **Br –** *i* (where *i* is 1, 2, or 3) is the branching ratio to the daughter **D –** *i*.

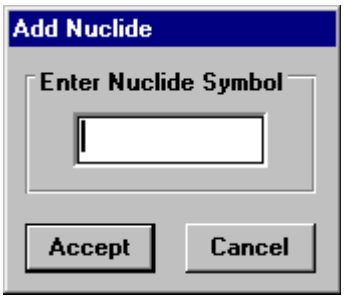

Fig. 93. Add Nuclide.

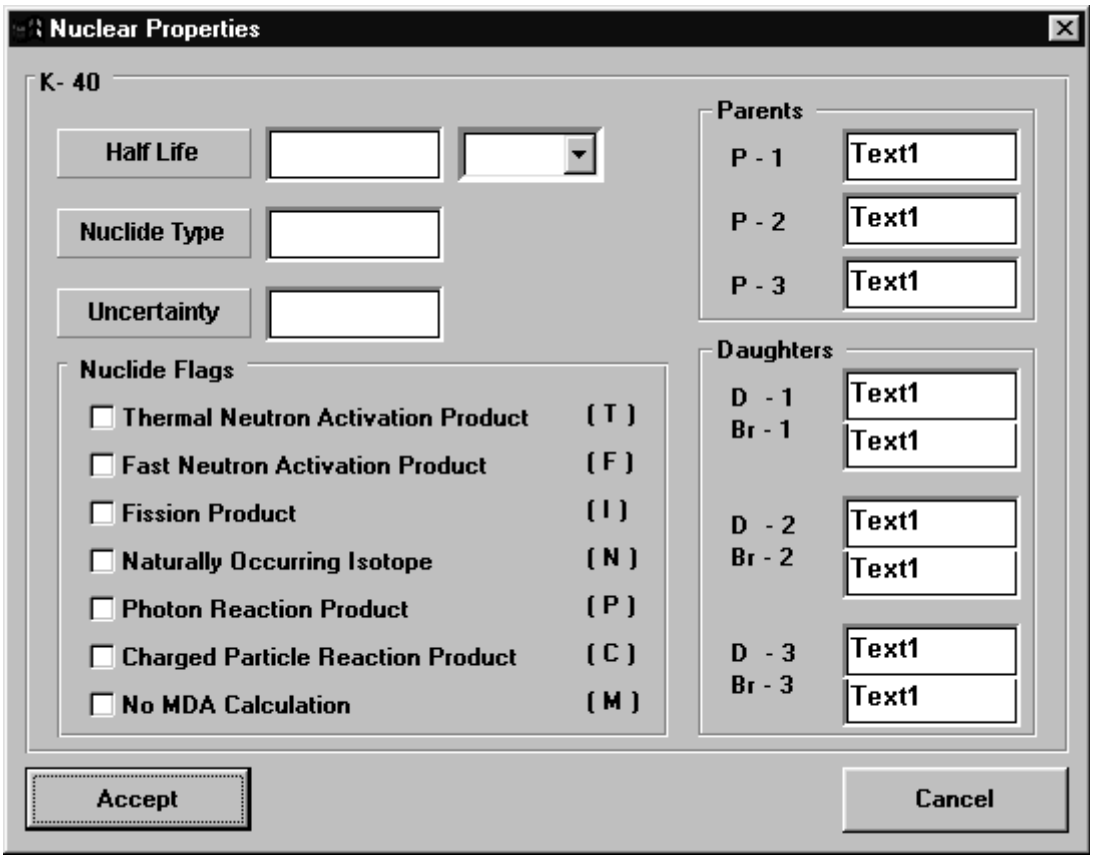

Fig. 94. Nuclide Properties Dialog.

6.2.7.2. Edit Nuclide...

Edits a nuclide in the library. The **Edit Nuclide** dialog is the same as the **Add Nuclide** dialog, except the current nuclide values are used for all entries.

6.2.7.3. Delete Nuclide

Removes the currently selected nuclide and its gamma rays from the library. A dialog opens to verify the deletion.

6.2.7.4. Add Gamma Ray...

Adds a gamma ray to the currently selected nuclide. This function is duplicated by <**Shift+Ins**>. The dialog is shown in Fig. 95.

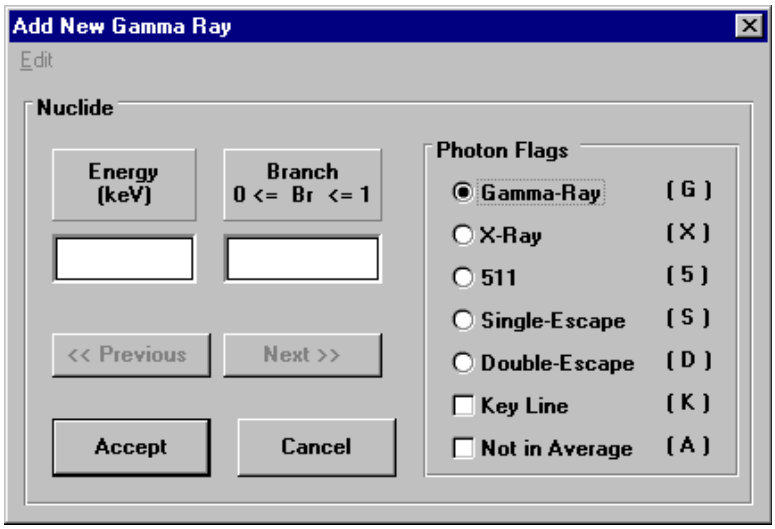

Fig. 95. Add Gamma Ray.

The **Energy** of the gamma ray must be positive and non-zero. The branching ratio (**Branch**) must be positive and non-zero. The value is absolute (not percent), and values greater than 1.00 are questioned for validity. However, values greater than 1 can be accepted since there are some branching ratios greater than 1. The **Photon Flags** are saved in the library for use by other programs.

6.2.7.5. Edit Gamma Ray...

Edits the selected gamma ray. The dialog is the same as the **Add Gamma Ray** dialog except the values of the selected gamma ray are displayed.

6.2.7.6. Delete Gamma Rays

Deletes the selected gamma rays. A dialog is displayed to verify each gamma ray before deletion. Duplicated by <**Shift+Del**>.

6.2.7.7. ReSort Gammas by ▸

This resorts the list of gamma rays by energy or branching ratio. This duplicates the buttons above the displayed list.

NOTE If alpha rays are selected, the instructions in Sections 6.2.7.4. through 6.2.7.7. hold for alpha rays instead of gamma rays.

6.2.8. Options (Target Window)

The **Options** menu is shown in Fig. 96.

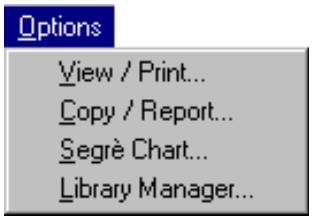

Fig. 96. Library Manager Options Menu (Target Window).

6.2.8.1. View/Print...

Displays the dialog in Fig. 97.

Radiation

Selects **Gammas**, **Alphas**, or **Betas** to be displayed or printed whenever any operation is selected.

Print Method

Selects between listing the contents of the library with all the nuclide information for all nuclides, followed by all emissions (gamma, alpha or beta) or with all emission data grouped with the nuclide data. The emissions can be listed in ascending energy order or by descending branching ratio order. See Figs. 26, 27, 28, and 29 as examples.

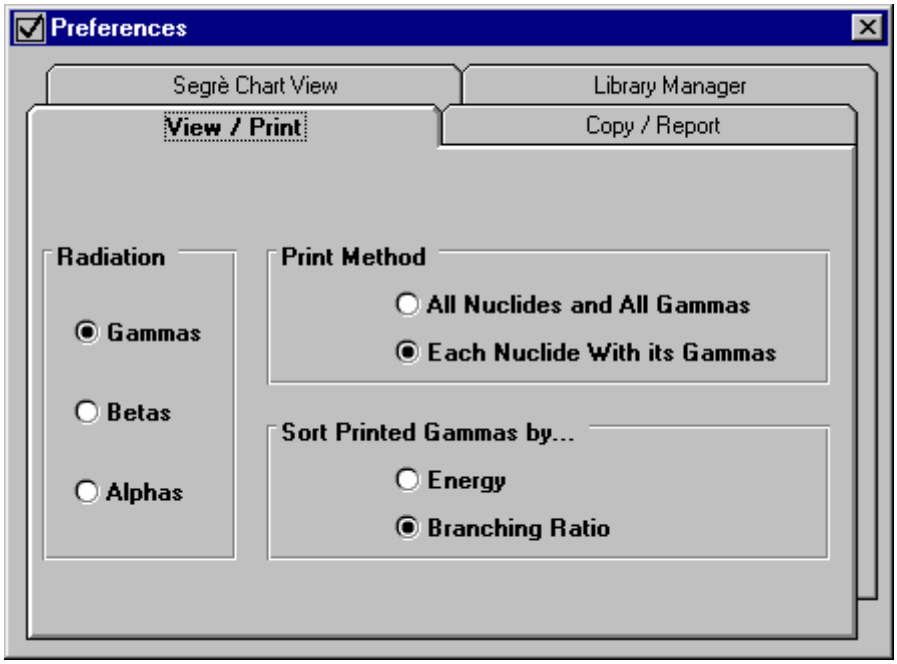

Fig. 97. View/Print.

6.2.8.2. Copy/Report...

The **Copy/Report** dialog is shown in Fig. 98.

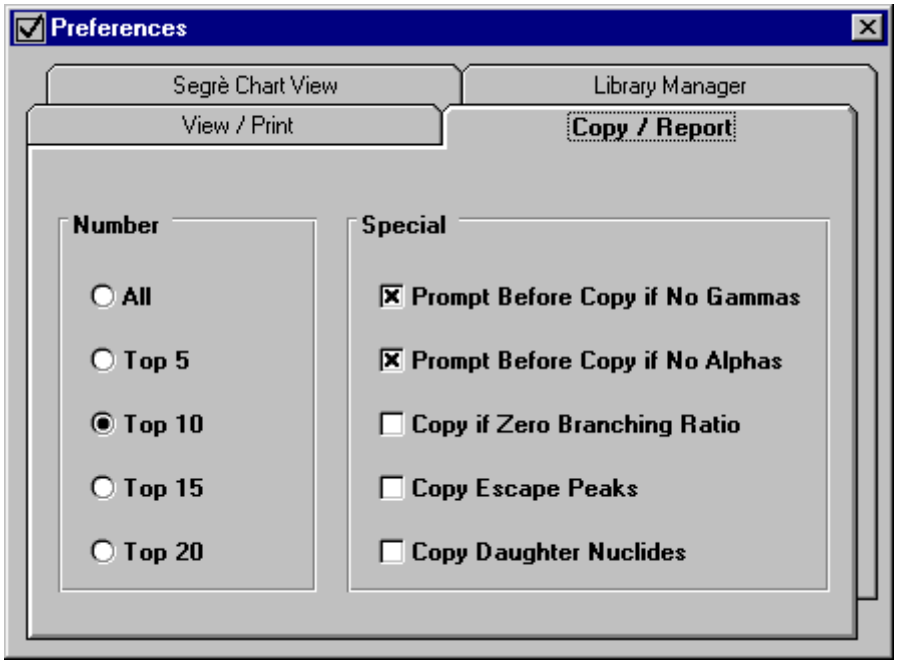

Fig. 98. Copy/Report Menu.

Number

Select from **All**, **Top 5**, **Top 10**, **Top 15**, or **Top 20** emissions to be listed on the report or copied to the target. The emissions with the highest branching ratio are selected. They are listed or copied in energy order. Use this option to filter out the least intense emissions from a nuclide's display, thus allowing quick identification of the top few emissions of a given nuclide. To turn off this filtering option, select **All** as the reporting option. The total number of emissions for a nuclide will always be listed, even if reporting all of a nuclide's emissions is not a choice.

Special

Prompt Before Copy if No Gammas

Marking this option turns on the dialog to verify that a nuclide with no gamma rays is to be transferred to the Target Library. This is only asked if the **View/Print, Radiation** mode is gammas.

Prompt Before Copy if No Alphas

Marking this option turns on the dialog to verify that a nuclide with no alpha rays is to be transferred to the Target Library. This is only asked if the **View/Print, Radiation** mode is alphas.

Copy if Zero Branching Ratio

Some entries in the master databases have zero for the branching ratio, usually because the "actual" valve is not known. Unmarking this option removes these from the copy function so that they will not be used by an analysis program.

Copy Escape Peaks

The escape peak intensity relative to other gamma rays for the same nuclide is not constant. Thus, these lines should not be used in activity calculations. For this reason, they can be eliminated from the target copy.

Copy Daughter Nuclides

When marked, this option copies all daughters of the selected nuclide to the target. The daughters are also checked for **No Gammas** or **No Alphas**.

6.2.8.3. Segrè Chart...

The Segrè Chart View (Fig. 99) selects the action to be taken when a nuclide is double-clicked in the Segrè Chart View.

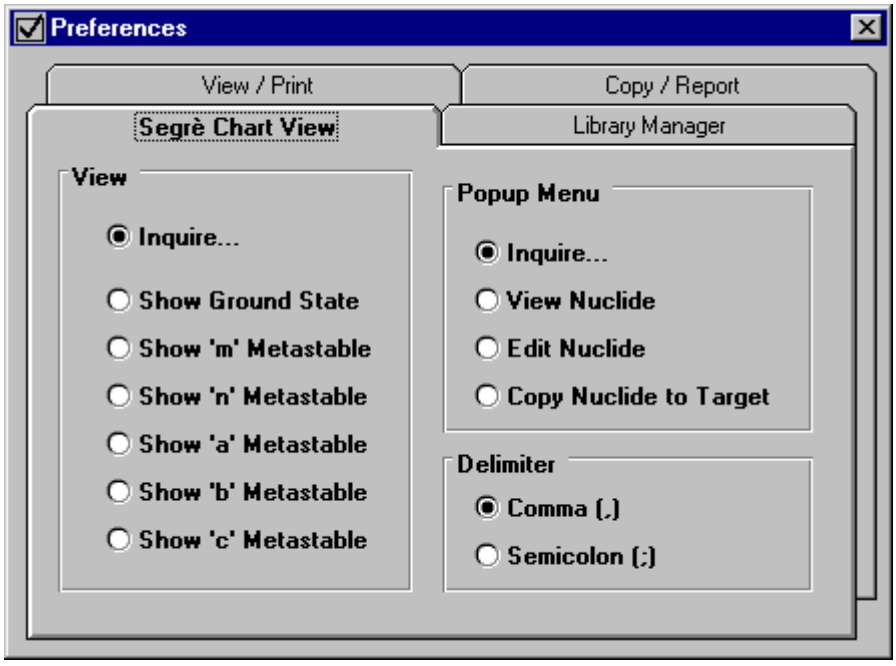

Fig. 99. Segrè Chart View.

Pop-Up Menu

Inquire...

This prompts for one of the following actions: **View Nuclide**, **Edit Nuclide**, or **Copy Nuclide to Target** whenever you double-click on a nuclide in the Segrè Chart View.

6.2.8.4. Library Manager...

The Thin Window Option (Fig. 100) shows only the nuclide list, while the Thick Window shows the nuclide and emissions

table. The Source and Target Dialogs can be linked together so you can more easily move them around the screen.

View Nuclide

Automatically displays the nuclide information, including half-life, branching ratio, and selected emissions. Additional information (such as parents, daughters, references, and associated gammas) is displayed when viewing the Master Library.

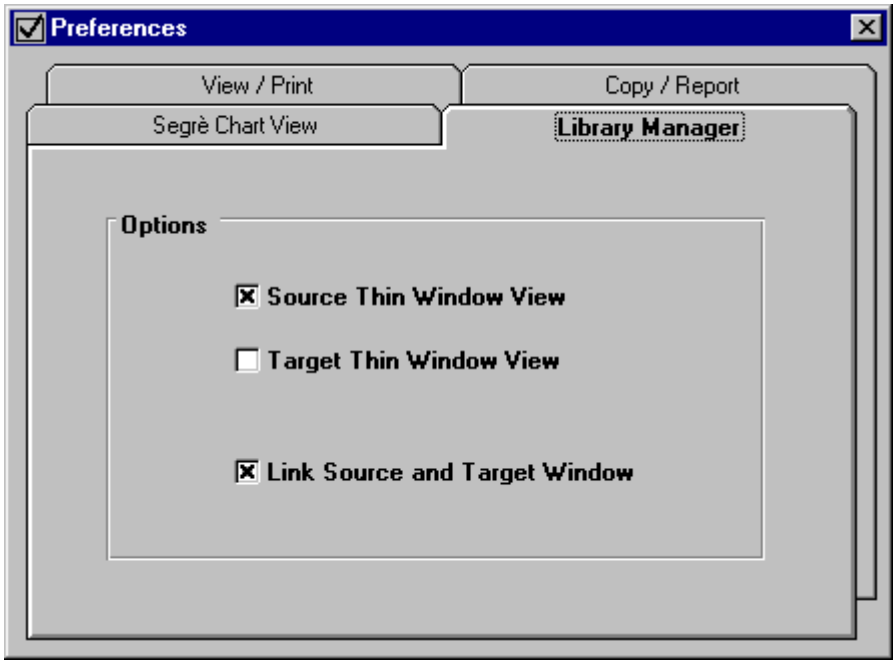

Fig. 100. Library Manager View.

Edit Nuclide

Allows you to edit the nuclides properties, such as half-life, nuclide type, and uncertainty. Several nuclide flags can also be edited. The Master Libraries cannot be edited.

Copy Nuclide to Target Library

Automatically copies the nuclide and its emissions to the selected Target Library. If no Target Library is selected, a dialog opens so you can select one.

APPENDIX A. INSTALLATION

A.1. Software Installation

Start Windows 95/98/NT. Put the NuclideNavigator III disk in the CD-ROM drive, then click on **Start** and **Run...**. In the Run dialog, enter **`D:SETUP.EXE`** (use your CD-ROM drive designator) and click on **OK**. Installation will proceed automatically from here — just answer the installation wizard questions, and be sure to restart the PC to complete installation.

To start NuclideNavigator, go to the Windows Taskbar and click on **Start**, **Programs**, **Nuclide Navigator**.

A.2. Program Components

`NN33.EXE`	Main application program.
`MASTER.MDB`	Master Library based on Erdtmann and Soyka.
`PC_NUDAT.MDB`	Master Library based on **`PC_NUDAT`**.
`TORI.MDB`	Master Library based on LLBL data.
`CONVERT.EXE`	Units Conversion program.
`PERIODIC.EXE`	Periodic table display program.

The convert program and the periodic table program can be changed to other programs. The name of the program is in the **`NN33.INI`** file in the **`\WINDOWS`** directory.

A.3. Other Required Files

The following files are installed into your **`WINDOWS\SYSTEM`** directory and are required to run the NuclideNavigator software:

`VBRUN300.DLL`	Microsoft Visual Basic runtime library.
`GRID.VBX`	Custom control providing grid functionality.
`THREED.VBX`	Custom control providing 3D controls.
`CMDIALOG.VBX`	Custom control enabling the use of Windows' common dialogs.

SSFORMFX.VBX	Custom control that enhances the look of NuclideNavigator's windows.
SSIDXTAB.VBX	Custom control providing toolbar functionality.
MSAJT200.DLL	Microsoft Access Jet Database Engine.
VBDB300.DLL	Allows NuclideNavigator to use the Access Database Engine.
MSAJT112.DLL	Allows NuclideNavigator to use the Access Database Engine.
NN33.INI	Control settings for NuclideNavigator startup.

APPENDIX B. FILE FORMAT

The Master Nuclide Libraries are stored in a relational database driven by the Microsoft Access database engine. Where possible, all data for **MASTER.MDB** was taken from the compilation of nuclide and gamma-ray energy data generated by and used with permission of Erdtmann and Soyka. For **PC_NUDAT.MDB**, all data was taken from the **NUDAT** compilation of nuclide and emission data generated by and used with permission of Brookhaven National Laboratory. Other information was supplemented from standard reference sources such as the *Radiological Health Handbook* and the *Chart of the Nuclides*.

The GammaVision libraries created by NuclideNavigator are completely compatible with all ORTEC software.

<<Previous 24
<Ctrl-Ins> 71
<Ctrl-O> 41, 58, 68
<Ctrl-P> 42, 58
<Ctrl-T> 42
<Shift-Ins> 69
3-D controls 77
About screen 68
Abundance
  elemental 4
  percent 1
Allocation values 35
Alpha ray search 13
Alpha rays 22, 48, 59, 65, 71
Annihilation peak 38
arrow buttons
  diagonal 9
  up and down 25
Branch button 25
Branching ratio 1, 13, 25, 34, 44, 60, 71, 73
calculations
  EBAR, IEQ, and MPC 37
Chart of the Nuclides 1
CMDIALOG.VBX 77
Color-code 4
Database 1, 9
database engine
  Microsoft Access 78, 79
  Microsoft Access Jet 78
DET.LIB 38
Emissions 24, 25, 44
Energy button 25
ENSDF 1
ENSDF.LIB 38
Equilibrium 37
Escape 1
Exit 43, 58
FOOD.LIB 37
gamma ray
  add 24, 34, 71
  delete 25, 33, 71
  edit 25, 71
  identification 13, 44, 60, 73
  search 13, 47
GammaVision library 2, 19, 21, 25, 41, 79
  how to build 30
  saving in GammaVision format . 35, 42, 43, 58
generations options 15, 23, 64
GRID.VBX 77
Half-life 70
Hardware 2
Help 57, 68
Help/Legend 4
IDX button 25
isotopes
  naturally occurring 4
  radioactive 4
  short-lived 14
  stable 4
Jump To Nuclide 9
Legend menu 57
library
  application 19, 37
  calibration 38
  creation 21
  management 19
  modification 22
  reporting 25
  save 35
Library Manager
  Edit Menu (Source Window) 59
  Edit Menu (Target Window) 69
  File Menu (Source Window) 58
  File Menu (Target Window) 68
  Options Menu (Source Window) 59
  Options Menu (Target Window) 72
Library Manager View 19, 21, 49, 58, 65
Limits
  energy range 14
  half-life 14
  nuclide-generation 15
Line of stability 9
Link Source & Target 21
MAESTRO library 38
Master Library 23, 30, 31
MASTER.MDB 1, 37, 77, 79
menu
  Edit 59, 69

File 41, 58, 68
Options 43, 59, 72
Popup 9, 21, 46, 62, 74
Tools 47
Microsoft Access Library 41
MIXCLB.LIB 38
MSAJT112.DLL 78
MSAJT200.DLL 78
NAC.LIB 38
NATURAL.LIB 37
Neutron absorption cross section 1, 4
Neutron activation 16
Next>> 24
NN33.EXE 77
NPP.LIB 37
nuclide
add 23, 31, 33, 69
copy 47, 68
daughter . . 1, 10, 22, 24, 45, 47, 62, 63, 70, 74
decay series 37, 56
delete 24, 32, 71
edit 47, 70
naturally occurring 37, 38
parent 1, 37
properties form 33
type 1, 33, 70
PC_NUDAT.MDB 1, 77, 79
Photon Flags 24, 34, 71
Popup menu 9, 21, 46, 62, 74
Print 42, 43, 58, 69
Print Method 25
progress indicator 15
PROMPT γ LIBRARY 39
radionuclides
mixed 38
Report 13, 25
Segrè Chart
File Menu 41
Options Menu 43
Tools Menu 47
Segrè Chart View 3
condensed 4
expanded 4
Source Library 23
open 41, 58
print 42
save as 42, 58
Source Library window 21
SRM-4275 39
SRM-4276 39
SRM4275.LIB 39
SSFORMFX.VBX 78
SSIDXTAB.VBX 78
SUSPECT.LIB 38
Target Library 23, 30, 31, 47, 63, 75
close 43, 69
open 30
print 43
save as 43
select 42
Target Library window 21
Thin Window View 21
THREED.VBX 77
Toolbar button
Decay Schemes 55, 67
Library Manager 19, 30
Library Search (gamma-ray search) 13
Zoom In/Zoom Out 47
Toolbox button 48
Tools Menu 47
Uncertainty 14, 33, 47, 63, 70, 75
VBDB300.DLL 78
VBRUN300.DLL 77
View Print 43, 59, 72
Yield 1, 25
Zoom 47

Chemical Names and Symbols

Sorted by Name

Actinium	Ac	Mercury	Hg
Aluminum	Al	Molybdenum	Mo
Americium	Am	Neodymium	Nd
Antimony	Sb	Neon	Ne
Argon	Ar	Neptunium	Np
Arsenic	As	Nickel	Ni
Astatine	At	Niobium	Nb
Barium	Ba	Nitrogen	N
Berkelium	Bk	Nobelium	No
Beryllium	Be	Osmium	Os
Bismuth	Bi	Oxygen	O
Boron	B	Palladium	Pd
Bromine	Br	Phosphorus	P
Cadmium	Cd	Platinum	Pt
Calcium	Ca	Plutonium	Pu
Californium	Cf	Polonium	Po
Carbon	C	Potassium	K
Cerium	Ce	Praseodymium	Pr
Cesium	Cs	Promethium	Pm
Chlorine	Cl	Protactinium	Pa
Chromium	Cr	Radium	Ra
Cobalt	Co	Radon	Rn
Copper	Cu	Rhenium	Re
Curium	Cm	Rhodium	Rh
Dysprosium	Dy	Rubidium	Rb
Einsteinium	Es	Ruthenium	Ru
Erbium	Er	Samarium	Sm
Europium	Eu	Scandium	Sc
Fermium	Fm	Selenium	Se
Fluorine	Fl	Silicon	Si
Francium	Fr	Silver	Ag
Gadolinium	Gd	Sodium	Na
Gallium	Ga	Strontium	Sr
Germanium	Ge	Sulfur	S
Gold	Au	Tantalum	Ta
Hafnium	Hf	Technetium	Tc
Helium	He	Tellurium	Te
Holmium	Ho	Terbium	Tb
Hydrogen	H	Thallium	Tl
Indium	In	Thorium	Th
Iodine	I	Thulium	Tm
Iridium	Ir	Tin	Sn
Iron	Fe	Titanium	Ti
Krypton	Kr	Tungsten	W
Lanthanum	La	Uranium	U
Lawrencium	Lr	Vanadium	V
Lead	Pb	Xenon	Xe
Lithium	Li	Ytterbium	Yb
Lutetium	Lu	Yttrium	Y
Magnesium	Mg	Zinc	Zn
Manganese	Mn	Zirconium	Zr
Mendelevium	Md		

Sorted by Symbol

Ac	Actinium	Mn	Manganese
Ag	Silver	Mo	Molybdenum
Al	Aluminum	N	Nitrogen
Am	Americium	Na	Sodium
Ar	Argon	Nb	Niobium
As	Arsenic	Nd	Neodymium
At	Astatine	Ne	Neon
Au	Gold	Ni	Nickel
B	Boron	No	Nobelium
Ba	Barium	Np	Neptunium
Be	Beryllium	O	Oxygen
Bi	Bismuth	Os	Osmium
Bk	Berkelium	P	Phosphorus
Br	Bromine	Pa	Protactinium
C	Carbon	Pb	Lead
Ca	Calcium	Pd	Palladium
Cd	Cadmium	Pm	Promethium
Ce	Cerium	Po	Polonium
Cf	Californium	Pr	Praseodymium
Cl	Chlorine	Pt	Platinum
Cm	Curium	Pu	Plutonium
Co	Cobalt	Ra	Radium
Cr	Chromium	Rb	Rubidium
Cs	Cesium	Re	Rhenium
Cu	Copper	Rh	Rhodium
Dy	Dysprosium	Rn	Radon
Er	Erbium	Ru	Ruthenium
Es	Einsteinium	S	Sulfur
Eu	Europium	Sb	Antimony
Fe	Iron	Sc	Scandium
Fl	Fluorine	Se	Selenium
Fm	Fermium	Si	Silicon
Fr	Francium	Sm	Samarium
Ga	Gallium	Sn	Tin
Gd	Gadolinium	Sr	Strontium
Ge	Germanium	Ta	Tantalum
H	Hydrogen	Tb	Terbium
He	Helium	Tc	Technetium
Hf	Hafnium	Te	Tellurium
Hg	Mercury	Th	Thorium
Ho	Holmium	Ti	Titanium
I	Iodine	Tl	Thallium
In	Indium	Tm	Thulium
Ir	Iridium	U	Uranium
K	Potassium	V	Vanadium
Kr	Krypton	W	Tungsten
La	Lanthanum	Xe	Xenon
Li	Lithium	Y	Yttrium
Lu	Lutetium	Yb	Ytterbium
Lr	Lawrencium	Zn	Zinc
Md	Mendelevium	Zr	Zirconium
Mg	Magnesium		